RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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Chronic Gastritis[1]

A Review of the Literature

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A MORE APPROPRIATE title for this paper would be "A Reconnaissance of the Literature Concerning Chronic Gastritis," as my purpose is to summarize the thoughts of the medical world on the subject. One has merely to thumb through the references Schindler used in his book on Gastritis to realize that volumes have been written about the disease, and years would be necessary to study and to put down accurately on paper the numerous facts and thoughts. Whenever volumes are written on any medical subject, one knows that it is a controversial one and that the facts are less numerous than the thoughts. This is most certainly true of gastritis, as the pathologists are not agreed among themselves, let alone in accord with the radiologists or the gastroscopists or the surgeons or the internists, among whom there are also at least two schools of thought. It may be that on this subject medicine must forsake as leaders or as authorities the anatomists and pathologists and turn to the physiologists for new criteria and yardsticks as to normal and abnormal. L. G. Cole's *The Pathological Yardstick*, S. A. Portis' *Gastroenterological Aspects of Psychosomatic Medicine*, and the book edited by Sodeman, *Pathological Physiology*, are thought-provoking from this aspect, and the matter should be considered seriously by all doctors, but particularly by radiologists. How many of us remember all the ptotic stomachs that were tacked up as late as the twenties because the anatomists told us the stomach belonged in a certain position? It was radiology that corrected this error. Radiology can also be of great help in clarifying the subject of gastritis.

This symposium was started because a patient with definite symptoms, showing a marked change in the antrum of the stomach, was subjected to a gastric resection; the surgeon saw and felt inflammation; the pathologist reported a normal stomach. The total number of cases seen by the contributors to the symposium was approximately 350 (we keep adding), with at least 50 cases studied surgically and gastroscopically.

HISTORY

An historical review of the subject of gastritis divides itself into three periods, the high lights of which may be listed as follows:

A. Period of Ascendancy, 1728–1838:

1728. *G. E. Stahl* is generally credited as being the first to mention gastritis as an entity.

1761. *Morgagni* went further and de-

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

scribed signs of gastritis or inflammation of the stomach.

1808. *Broussais* gave the main impetus to the study and diagnosis of gastritis. He thought that gastritis was the cause of ascites and such diseases as typhoid fever and meningitis. The fourth edition of his book, translated into English in 1831 by Hays and Griffith, spread the popularity of the diagnosis to the English speaking physicians.

1833. *Beaumont's* studies of Alexis St. Martin's visible stomach added facts and concepts about the function of the gastric mucosa and the action of stimuli upon it.

1838. *Carswell* pricked the bubble by proving that the changes ascribed to gastritis were merely postmortem changes. Even so, the enthusiasm stirred up by Broussais kept the diagnosis of gastritis popular with Europeans till the end of the century.

B. Wane of Interest, 1838–1922:

1855. *Rokitansky* described gastritis as being very common in the antrum.

1869. *Kussmaul* swung the interest from anatomical to physiological by introducing the gastric tube.

1870–77. *Fenwick* described atrophic gastritis and its association with age and chronic diseases.

1892. *Hayem and Faber*, having prevented postmortem changes in the stomach, found no signs of gastritis, and so stated that there was no such thing as gastritis. This, with Carswell's statements, made the diagnosis a very unpopular one, and this attitude has carried over to the present day. The pathology text used by my class in medical school (1940) discusses gastritis briefly as secondary to cancer and ulcer of the stomach. The book used in 1945–48, and probably still in use, briefly describes atrophic gastritis as an entity but passes over chronic hypertrophic gastritis as being merely an effect of the submucosa muscularis.

1913. *Konjetzny* and his school—Puhl, Hurst, Orator, and others—proclaimed that atrophic gastritis is the precursor of cancer. This thesis was accepted without much question and is the basis for the general pathological thought concerning gastric cancer. Konjetzny also fostered the idea that gastritis is a precursor of gastric ulcers.

C. Reawakening, 1922-1951:

1922. *Schindler's* enthusiasm for the gastroscope, and studies of war veterans with long-standing epigastric distress but no demonstrable abnormality other than the gastroscopic picture, brought an immediate upsurge of interest. This has continued because of three factors: (1) gastroscopy (Schindler, Henning, Gutzeit, Korbsh, Benedict and others); (2) roentgen examination with pressure technic (Rendick, Forssell, Cole, Berg, Holzknecht, and others); (3) surgical material, obtained largely because of the European idea of gastric resection for all gastric ulcers.

1951. Re-evaluation is now the keynote, with interest still running high. The gastroscope is not all-seeing; the pathologist is searching for new criteria; the surgeon is more cautious about removing a "normal" (?) stomach; the radiologist knows that the x-ray is not worthless in establishing the diagnosis.

WHAT IS GASTRITIS?

As we have just seen, first, everyone has gastritis; next, there is no such thing as gastritis; again, gastritis is found only secondary to ulcers (gastric or duodenal) or gastric cancer, and, on the other hand, gastritis is primary, with ulcers or cancer developing from it. Why?

First, there is the difficulty in obtaining specimens undamaged by postmortem changes, by agonal changes, or by traumatic changes due to surgery. The controversy then is: "What is a normal stomach?" The facts are:

1. There is a definite increase in lymphoid tissue and cellular infiltration up to age forty, where a leveling off occurs.

2. Achlorhydria is common in geriatric cases; estimates run from 10 to 75 per cent.

3. Metaplasia and/or atrophy are seen in supposedly normal stomachs at all ages.

However, the gastroscopists and pathologists are fairly well agreed on the following classification:

Gastroscopist	*Pathologist*
1. Superficial gastritis: Reddening, edema, and adherent secretions.	1. Acute exudative gastritis: Edema, small erosions, polymorphonuclear infiltration.
2. Hypertrophic gastritis: Mucosa studded and dull.	2. Chronic gastritis: Hypertrophy of glands; plasma-cell and lymphocytic infiltration.
3. Atrophic gastritis: Thin gray mucosa, decrease in rugal folds, vessels visible.	3. Atrophic gastritis: Thin mucosa, atrophic glands, absence of parietal cells; infiltration with plasma cells and lymphocytes.

Schindler classifies all three types as chronic gastritis, with two subtypes: the superficial-atrophic as one and the hypertrophic as the other.

Second, what are we, the radiologists seeing? Fluoroscopically the stomach is not normal in appearance or action; pictorially the stomach is not normal, as any surgeon or internist will tell you and as you know (read Twining, 46). We may be seeing pathological physiology rather than pathology. As L. G. Cole (11) says, these changes are best observed as follows:

1. By x-ray.

2. By surgery, *in situ:* edema and congestion.

3. In fresh pathological specimens carefully removed and immediately examined, not permitted to stay in the specimen basin to dry out and become drained of blood. Walters and Sebening (49) at the Mayo Clinic substantially proved that the antral gastritis which German workers said was present in all cases of duodenal ulcer was attributable mainly to surgical trauma. The usual pathological specimen will seldom show the real changes encountered on x-ray examination and surgery.

Third, antral gastritis, which is the hypertrophic type, is considered by the radiologists participating in this symposium, and by the pathologists and the surgeons, to be the most common form of hypertrophic gastritis; the gastroscopists say it is uncommon. It may be that the answer lies in Schindler's own statements: "In every case in which gastritis was diagnosed gastroscopically, histologic evidence of *marked* gastritis was also found," and "The skilled gastroscopist will rarely diagnose gastritis when it is not present." It is a well known fact that the prepyloric stomach is one of the blind spots for the gastroscopist. If he diagnoses only "marked" cases of gastritis, what of all the intermediate phases?

Consider S. A. Portis' statement (37): "A normal digestive tract cannot have continuous emotional stimuli reach it day by day, week after week, month after month, year after year, and still remain normal without showing evidence of physiological and structural change. We, however, have failed to recognize these changes. Increasing clinical experience with laboratory and roentgenologic evidence must show some deviation from the normal if the patient has symptoms. Any gastroenterologist with a broad clinical experience will honestly admit that a majority of his patients have a symptom complex for which no organic basis can be found."

Also, H. G. Wolff and S. Wolf (50): "The hypersecreting stomach is always hyperemic, turgid, engorged, regardless of the stimulus, food, alcohol, histamine, or emotionally charged situations. When the state is prolonged, the patient experiences pain and abdominal discomfort."

ETIOLOGY

Various writers have listed as many as eight different causes of chronic gastritis. I am listing the five most agreed upon and most probable etiologic factors.

1. *Irritants:* Poisons, alcohol, coffee, seasonings, etc. These are usually thought of as causing acute gastritis, but continued usage will eventually lead to chronic gastritis. An interesting sidelight is a report by

veterinarians that calves on changing from milk to fodder will show acute erosive gastritis for one to two months.

2. *Hematogenous Agents:* It is a known fact that gastritis may be associated with such diseases as typhoid, tuberculosis, influenza, and uremia. This is thought to be due to hematogenous spread.

3. *Mechanical Factors:* The churning action of the stomach pushing against the antrum is considered to be a definite etiologic factor.

4. *Nervous Mechanism:* This has been suggested in numerous articles, particularly in relation to smoking and duodenal ulcers. Most cases of antral hypertrophic gastritis have been in individuals under tension, such as business executives. The descriptions by Beaumont and by Wolf and Wolff of the response of the stomach to emotional stimuli and Portis' theorizing (previously mentioned) seem to support this as a factor.

5. *Allergy:* Allergy was first proposed as a factor in 1927. There seems to be no doubt that allergies can produce changes in the stomach, including ulcers. One article (35) reports that pyribenzamine is almost specific in the treatment of antral gastritis.

PATHOLOGY

The pathological aspects of gastritis will be discussed in detail by others on this symposium. A general summation of thought expressed in the literature is as follows. There may be any and all stages of inflammation, the opinion now being (stated by Faber in 1904) that the atrophic form is probably one end-result of chronic inflammation, while the hypertrophic form is another type of response to the same factors. It is also generally accepted that *état mammelonné*, gastritis polyposa, follicular gastritis, and cystic gastritis are all varieties of chronic hypertrophic gastritis.

The antral type of chronic hypertrophic gastritis is thought at first to be limited to the mucosa; as chronicity develops, it involves the deeper layers, even to the serosa, resulting in an irreversible change, the so-called "antral fibrosis."

SYMPTOMATOLOGY

Simply stated, *atrophic gastritis* causes belching and a sense of fullness unrelated to meals or alkalis, but no pain. *Hypertrophic gastritis* simulates prepyloric or duodenal ulcer in causing epigastric distress, burning or aching relieved by alkalis or bland foods and aggravated by spices. Bleeding, which may even be exsanguinating, occurs without ulcer formation in 1 to 5 per cent of the cases of upper gastrointestinal bleeding.

RELATIONSHIP TO ULCER AND CANCER

Ulcer: Konjetzny, Faber, and others feel that gastritis usually is the precursor of ulcer, as some feel that duodenitis is the precursor of duodenal ulcer. However, vascular spasm or some condition leading to ischemia is generally accepted as the most probable cause.

Cancer: Konjetzny is definitely the father of the thought that gastritis is a precursor of cancer. His original idea was that atrophic gastritis was the precursor, but over the years all chronic gastritis was included. However, although metaplasia is common in chronic hypertrophic gastritis, there does not appear to be any definite proof that any relationship exists.

In regard to chronic atrophic gastritis, disproving the Konjetzny theory has been difficult. It is still considered a precursor of cancer, despite the works of Guiss and Stewart.

VALUE OF X-RAY EXAMINATION

Numerous writers, including Templeton at one time and Schindler, have said that the x-ray is of little or no value in diagnosing gastritis. But now we radiologists are being criticized because we cannot distinguish between gastritis and carcinoma or between gastritis and prepyloric ulcer. Twining, in 1933, reviewed 92 cases from the literature studied by x-ray, in only 3 of which was the correct diagnosis even suggested (not made). All had been diagnosed as ulcer, a malignant growth, or simply lesion of the stomach. All had

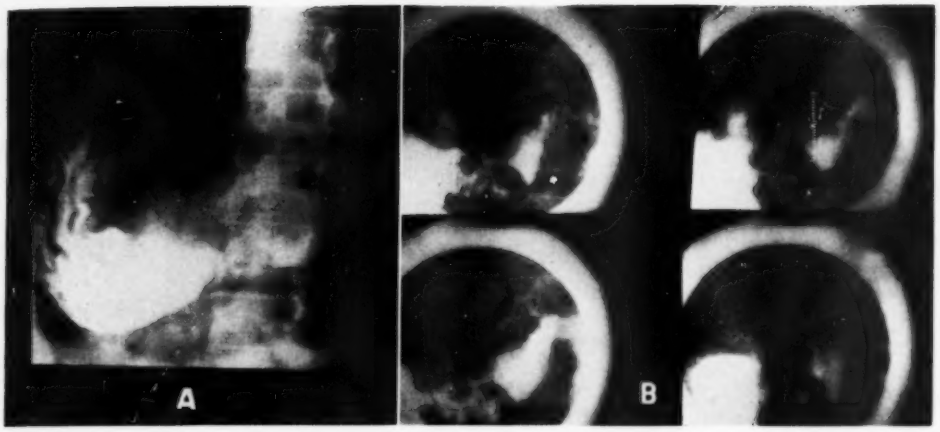

Fig. 1. Is this stomach normal? See text. A. Full stomach. B. Detail of antrum without pressure.

changes seen on x-ray examination. All were gastritis.

There is no doubt that roentgen examination, even with pressure technic, is of very little value in diagnosing atrophic gastritis. But there is equally no question that x-ray examination, even *without* pressure technics, is of considerable value in diagnosing hypertrophic gastritis. We must all recognize the fact and learn to make the differentiation from ulcer, and particularly from cancer. In antral gastritis we have to be the leaders, as it is difficult for the gastroscopist to see this area and it is unfair to the patient to leave the differential diagnosis to the surgeon or pathologist.

SUMMARY

1. Some 350 cases of gastritis of which 50 have been observed gastroscopically and/or come to surgery have been studied by the various members of the symposium.

2. Chronic gastritis is a very controversial subject; disputes have raged since 1728 and even now are not about to cease.

3. Chronic gastritis is a definite pathological entity which is mistaken by roentgenology, by gastroscopy, and by surgery, for the entities of cancer and ulcer.

4. Etiological factors are varied.

5. Chronic hypertrophic gastritis does not seem to be a precursor of cancer; chronic atrophic gastritis may be, but this is questionable. Gastritis, acute or chronic, may be a precursor of ulcer.

6. The x-ray is of considerable value in establishing the diagnosis in chronic hypertrophic gastritis, particularly of the antrum, and in making a differentiation from cancer or ulcer.

7. "Gastrosis" of the antrum? Antral gastritis? Pathological physiology? Whatever we may call it, we are seeing changes in the antrum that the surgeon can see, that the gastroscopist usually cannot see, and that the pathologist reports as "normal stomach." We radiologists in co-operation with our fellow doctors have an obligation to our patients to find out what these changes signify, or at least to recognize them as a benign process unrelated to malignant disease.

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SUMARIO

Gastritis Crónica: Repaso de la Literatura

Este repaso de la literatura relativa a la gastritis crónica sirve de introdución a un certamen basado en 350 casos, por lo menos 50 de los cuales fueron estudiados gastroscópica y quirúrgicamente.

La gastritis crónica es una entidad patológica bien definida que, sin embargo, se confunde frecuentemente con cáncer y úlcera, roentgenológica y gastroscópicamente, y al operar.

La etiología es variada. Las formas atrófica e hipertrófica pasan por representar dos distintos tipos de reacción a los mismos factores. La última no parece ser precursora del cáncer; la primera puede serlo, aunque esto parece dudoso.

La roentgenología es de poco valor en el diagnóstico de la gastritis atrófica, pero posee mucha utilidad en el de la hipertrófica, en particular en la del antro pilórico, y en la formulación del diagnóstico diferencial del cáncer y de la úlcera.

Antral Gastritis[1]

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ANTRAL GASTRITIS is an inflammation of the antral portion of the stomach of unknown etiology, which probably begins in the mucosa, usually involves the submucosa, and may even extend to the serosa. The roentgen changes are sufficiently characteristic that the radiologist should be able to make a correct diagnosis in most cases. This condition must always be considered in the differential diagnosis of lesions in the antral region.

There will be some discrepancies in the diagnosis of gastritis by the gastroscopist, radiologist, and pathologist. The gastroscopist has an opportunity to observe the mucosa, its movements and color, and the effect of the peristaltic waves on the rugae. Superficial ulceration is readily apparent on gastroscopy. The radiologist can study the thickness and movement of the rugae and can detect ulceration when the ulcers are deep enough to cause a crater. He also has the opportunity to make a thorough study of peristalsis. The pathologist does not have as good a chance to determine the thickness of the rugae as the radiologist and gastroscopist. He does have the advantage of being able to study the entire wall of the stomach. There may, however, be some variation in the opinion of different pathologists as to the diagnosis, since microscopically the changes of early or moderate gastritis differ only slightly from the microscopic picture of the normal stomach.

Most of our cases of antral gastritis have been in males from forty to seventy years of age. Haworth and Rawls (12), in their series, found an almost equal distribution between the sexes. The majority of the patients show hyperacidity, but this is not so marked as in duodenal or gastric ulcer cases. In a few cases there is an anacidity. Benedict (4) reports the occurrence of hemorrhage in 19.7 per cent of a series of cases of gastritis which he analyzed. Severe hemorrhage has not been present in any of our cases.

The clinical picture of antral gastritis is not definite enough to justify a diagnosis on this basis alone. These patients usually complain of vague epigastric distress. Some state that they feel better after eating, while others do not obtain food relief. Some authorities feel that excessive use of coffee, alcohol, and tobacco may be the cause of antral gastritis in some instances. We have seen a few patients, however, who did not use tobacco or alcohol and took only an occasional cup of coffee. Our internists feel that abstinence from coffee, alcohol, and tobacco is in general as important as diet in the treatment of antral gastritis. The majority of these patients improve clinically under an ulcer regime.

Follow-up roentgen examinations have shown regression of the process in a few patients under medical management. Usually there will be little change in the roentgen findings, even though there is considerable symptomatic improvement.

The gastroscopist can be of assistance in the diagnosis of antral gastritis in some patients. Our experience with gastroscopy, however, has been limited. We have found repeat x-ray examination after ten days of strict medical management of aid in most cases.

Many patients in whom a diagnosis of antral gastritis is made may have a gastritis of the entire stomach which we are unable to demonstrate roentgenologically. Occasionally, also, patients in whom we have made a diagnosis of antral gastritis may appear more or less normal to the

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[1] From the Department of Radiology, Quain and Ramstad Clinic, Bismarck, N. Dak. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

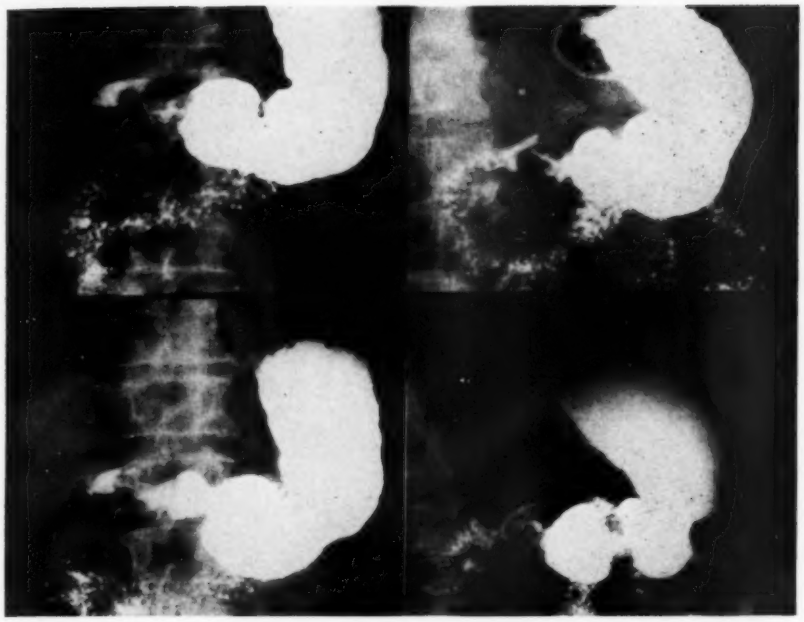

Fig. 1. Antral gastritis in a male, age 66. Note spasm, hypertrophy of rugae, and herniation of gastric mucosa into duodenal bulb.

TABLE I: INCIDENCE OF ANTRAL GASTRITIS DIAGNOSED ROENTGENOLOGICALLY AT THE QUAIN AND RAMSTAD CLINIC

No. roentgen examinations of stomach during thirty months		5,520
No. cases diagnosed roentgenologically as antral gastritis		139
Antral gastritis associated with duodenal ulcer, duodenitis, gastric ulcer, or gastro-enterostomy	80	
Antral gastritis without other demonstrable lesion in stomach or duodenal bulb	59	
Additional findings in this group of 59 cases:		
Cholelithiasis or non-functioning gallbladder	8	
Herniation of the gastric mucosa into the duodenal bulb	11	

gastroscopist. The reverse is true, as well.

In a consecutive series of 5,520 roentgen examinations of the stomach, over a thirty-month period in a clinic and hospital practice, the diagnosis of antral gastritis was made 139 times. It is not necessary here to go into the classification of gastritis, which is covered elsewhere in this symposium. All the cases in our series were of the type usually classified as hypertrophic antral gastritis by the radiologist. All cases of generalized gastritis were excluded. In 59 of the 139 cases no other abnormality was demonstrable in the stomach roentgenologically, except for herniation of the gastric mucosa into the duodenal bulb in 11 instances. The defect produced by this herniation into the bulb was not of the type indicating pyloric hypertrophy described by Kirklin and Harris (16).

The incidence of lesions in the stomach and duodenal bulb associated with antral gastritis in this series is shown in Table II.

TABLE II: INCIDENCE OF OTHER LESIONS OF THE STOMACH AND DUODENUM ASSOCIATED WITH ANTRAL GASTRITIS

Total no. cases with other lesions		80
Antral gastritis and prepyloric ulcer	4	
Antral gastritis and gastric ulcer	13	
Antral gastritis and duodenal ulcer	40	
Antral gastritis and duodenitis	15	
(Herniation of gastric mucosa into duodenal bulb 2)		
Antral gastritis, duodenal ulcer, and gastric ulcer or prepyloric ulcer	6	
Antral gastritis, duodenal ulcer, and gastro-enterostomy with small stoma	2	

The roentgen changes in hypertrophic

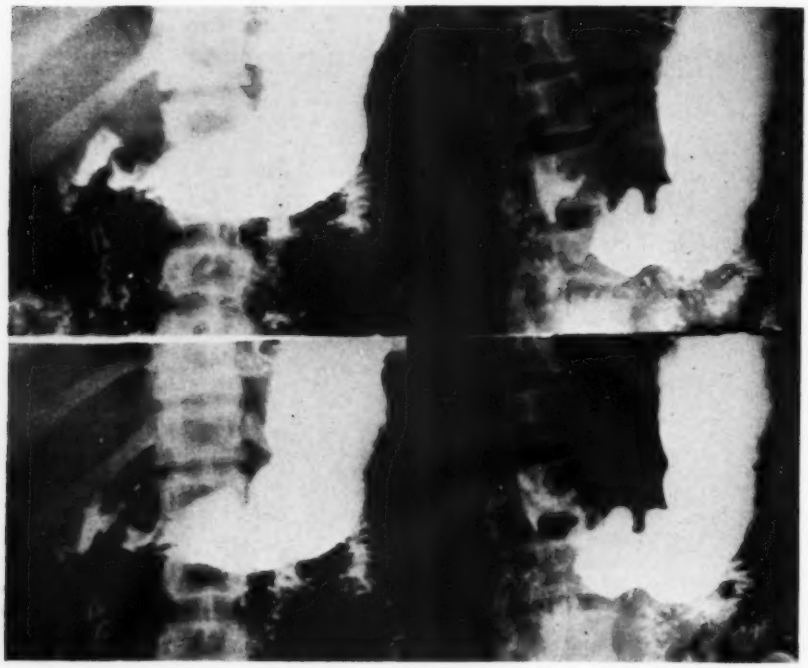

Fig. 2. Antral gastritis in a female, age 22. Note thickening of rugae, spasm, and tendency of rugae to maintain horizontal position in antral systole. Patient observed for three years. Resection finally performed because medical management did not relieve gastric symptoms. Diagnosis confirmed pathologically.

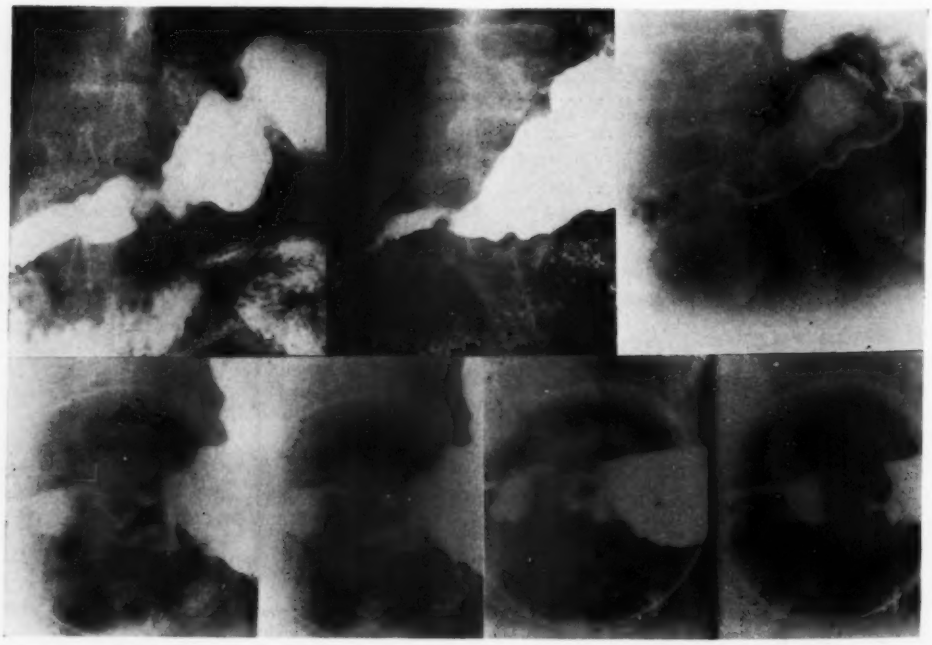

Fig. 3. Antral gastritis in a male, age 64, observed for three years. Frequent exacerbation of symptoms. Perforated duodenal ulcer during period of observation. Physical condition not favorable for resection.

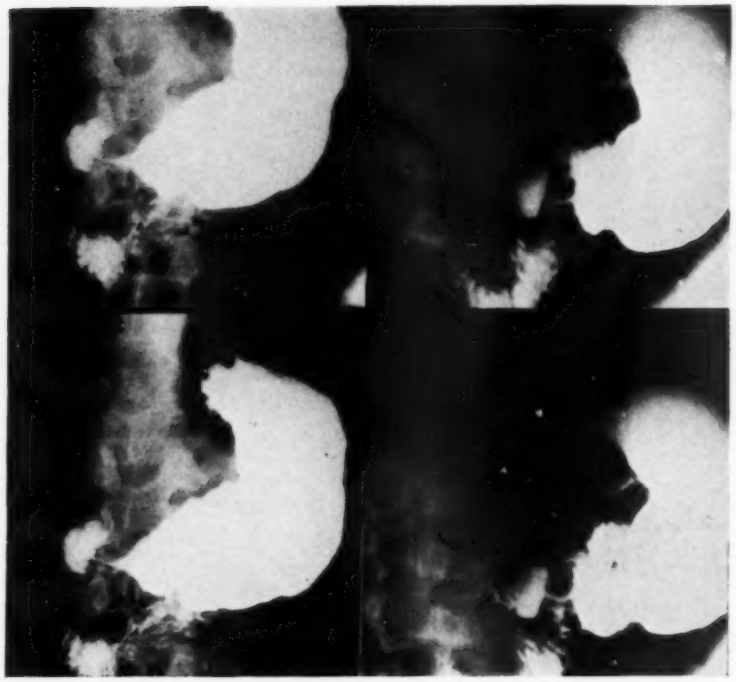

Fig. 4. Deformity very suggestive of a carcinoma, in a male, age 67. A resection was done. *Pathological diagnosis:* antral gastritis.

TABLE III: ROENTGEN CHANGES SEEN IN ANTRAL GASTRITIS

1. Hypersecretion
2. Pylorospasm, antral spasm, and narrowing of antral region
3. Shortening of antral region due to contraction of longitudinal muscles
4. Gastric folds usually enlarged, sometimes with polypoid appearance. (Some cases are seen, however, in which the mucosa is smooth, as it appears in scirrhous carcinoma.)
5. Stiffness of folds in antral region due to infiltration of submucosa. (Folds do not flatten out on pressure of the examiner's hand and do not thin out with peristalsis.)
6. Irregularity of peristalsis in antral region
7. Prolapse of gastric mucosa into duodenum
8. Hypertrophy of pyloric musculature in some cases
9. Delay in emptying time of stomach due to antral spasm and pylorospasm
10. Small ulcer craters sometimes detectable in involved area

antral gastritis are shown in Table III. Usually, only part of the changes listed will be found in any one case. The changes seen roentgenologically are due mainly to edema and infiltration of the mucosa and submucosa and spasm.

It is difficult to differentiate antral gastritis from other lesions that occur in this area, such as prepyloric ulcer, hypertrophy of the pylorus, and carcinoma. The most important factor in the differentiation from carcinoma is a careful study of the rugae. In antral gastritis one should be able to trace the rugae through the involved area, though an occasional case is encountered in which this is impossible. There should be no interruption of the rugae and no abrupt break in the rugal pattern, nor should there be any disturbance of the rugal architecture. The best method of studying the rugal pattern, in our hands, has been by spot films, with varying degrees of compression, and with one of the technics described below.

After vertical fluoroscopic studies are completed, the patient is placed in the supine position. The right side is then elevated and the stomach palpated. The barium flows into the fundus and air escapes into the antrum. Double-contrast

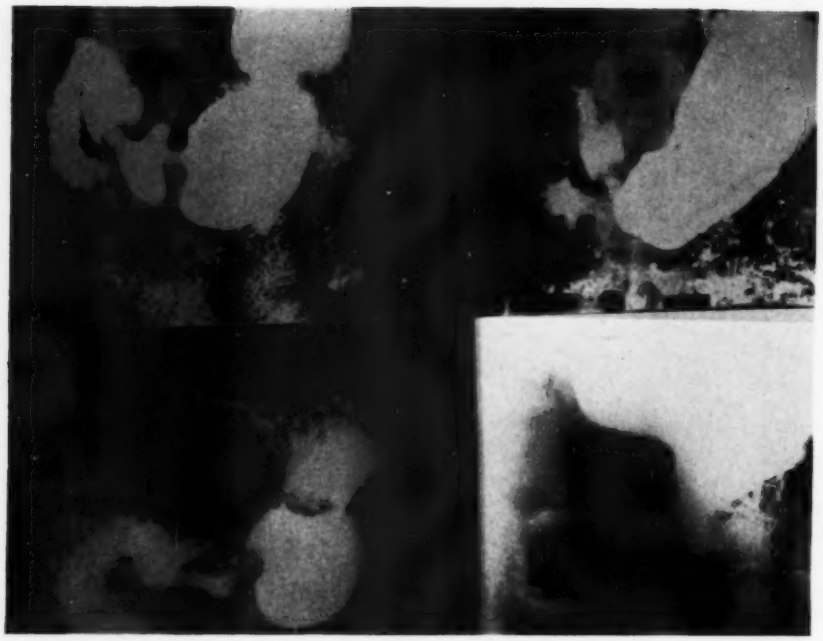

Fig. 5. Male, age 41. Since it was felt that a malignant lesion could not be ruled out, resection was performed. *Pathological diagnosis:* antral gastritis.

spot films are then taken of the antral region. Studies made in this manner give a very good demonstration of the rugal pattern. Another method which is frequently of value consists in taking films in the supine and prone positions with only a small amount of barium in the stomach. It must always be kept in mind that a normal rugal pattern can be shown on films of the anterior or posterior wall with a lesion on the opposite wall which may very easily be missed. (Figs. 1–3)

The most important findings in cases suspected of being antral gastritis, but which in reality are carcinoma, are as follows:

(1) In antral gastritis there is usually considerable associated spasm with a delay in the escape of barium into the duodenum. Therefore, if barium escapes easily and early into the duodenal bulb, with changes in the antral region, an early carcinoma should be suspected. This rule does not apply if the carcinoma has progressed to the point where it is causing obstruction, but at that stage there will usually be no question as to the diagnosis. (2) A palpable mass would indicate that the patient has a carcinoma and not an antral gastritis. (3) An abrupt break in the rugal pattern or changes in the architecture of the rugae suggest that the process is probably a new growth. (4) Failure of peristaltic waves to pass through the antrum is strongly suggestive of a new growth. However, peristalsis may occasionally be present even in the presence of a malignant process. (5) In carcinoma, the character of the deformity of the antral region remains constant, whereas in antral gastritis some changes will usually be seen on the various views. (6) In carcinoma there is usually a sharp transition or change from the normal, uninvolved area to the area showing roentgen changes. In antral gastritis the transition is very gradual. (7) The presence of anacidity suggests carcinoma, but anacidity may occur in antral gastritis and free acid can be found with a carcinoma. (Figs. 4–6)

Pyloric hypertrophy is another condi-

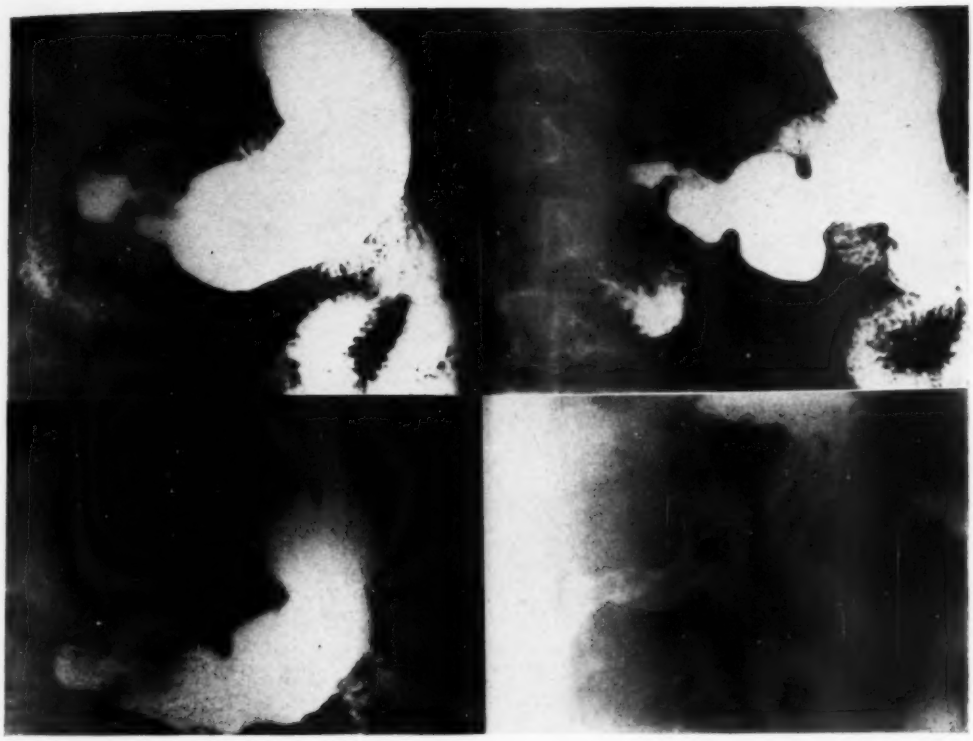

Fig. 6. Male, age 52. The deformity of the prepyloric area remained fairly constant, changing only slightly on various views. A malignant process was suspected and a resection was done. *Pathological diagnosis:* antral gastritis.

tion that is difficult to differentiate from antral gastritis and carcinoma in this area. Golden (10) quotes various authors to the effect that pyloric hypertrophy may be associated with or caused by a preceding antral gastritis. A crescent-shaped indentation of the base of the bulb, as described by Kirklin and Harris (16), is strongly suggestive of pyloric hypertrophy, and this sign, when present, is of assistance in the differential diagnosis (Figs. 7 and 8).

The sign of pyloric hypertrophy described by Twining (24), namely a triangular outpouching on each side in the prepyloric area between the hypertrophied pyloric and the thickened prepyloric musculature, is also an aid in diagnosis.

We have had two patients, one with generalized and one with antral gastritis, in whom we thought that a polyp was present. At the time of surgery, however, what we had interpreted as a polyp was found to be a localized thickening of the mucosal folds. In the case of antral gastritis the pseudo-polyp was the result of localized hypertrophy of the mucosal folds and a small submucosal nodule of pancreatic tissue. This pseudo-polyp formation in gastritis has been described by Golden and others (Fig. 9).

Some cases which appear to be typical of antral gastritis may prove on operation to be carcinoma, as in a case reported by Dr. Fay Alexander (1).

Two of the 59 cases of antral gastritis in this series came to surgery, and the diagnosis was confirmed. The other 57 patients have been followed carefully for over a period of two years or more, and in none, so far as we have been able to determine in our follow-up, has malignant change occurred.

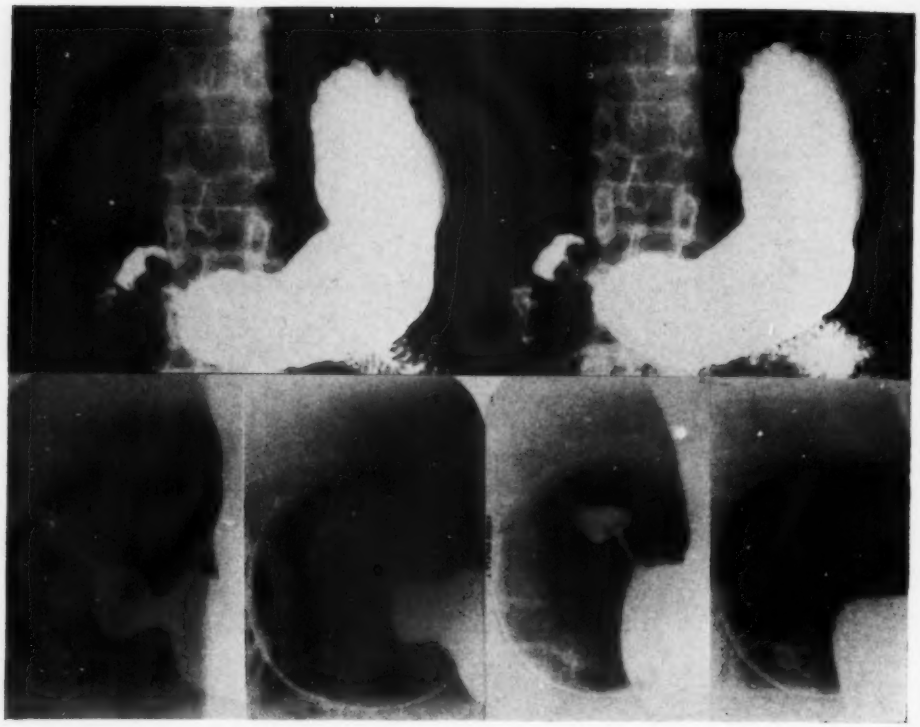

Fig. 7. Male, age 62: radiologic diagnosis, probable carcinoma. The crescent deformity of the base of the bulb suggested pyloric hypertrophy, but it was felt that a malignant lesion could not be ruled out. *Pathological diagnosis:* pyloric hypertrophy and antral gastritis. See Fig. 8.

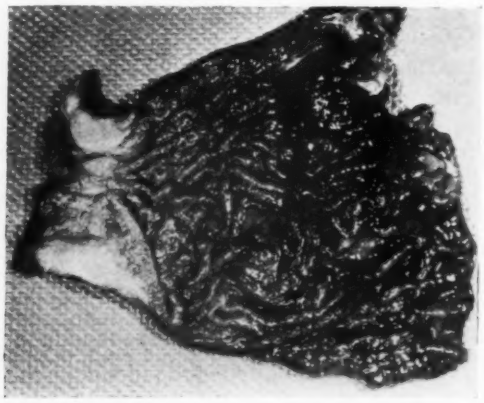

Fig. 8. Photograph of specimen from case shown in Fig. 7. Note hypertrophy of the pylorus and thickening of the gastric rugae.

During this period of study of lesions in the antral region we have made a diagnosis of probable cancer in 11 cases which were reported as benign by the pathologist following gastric resection. These cases are as follows:

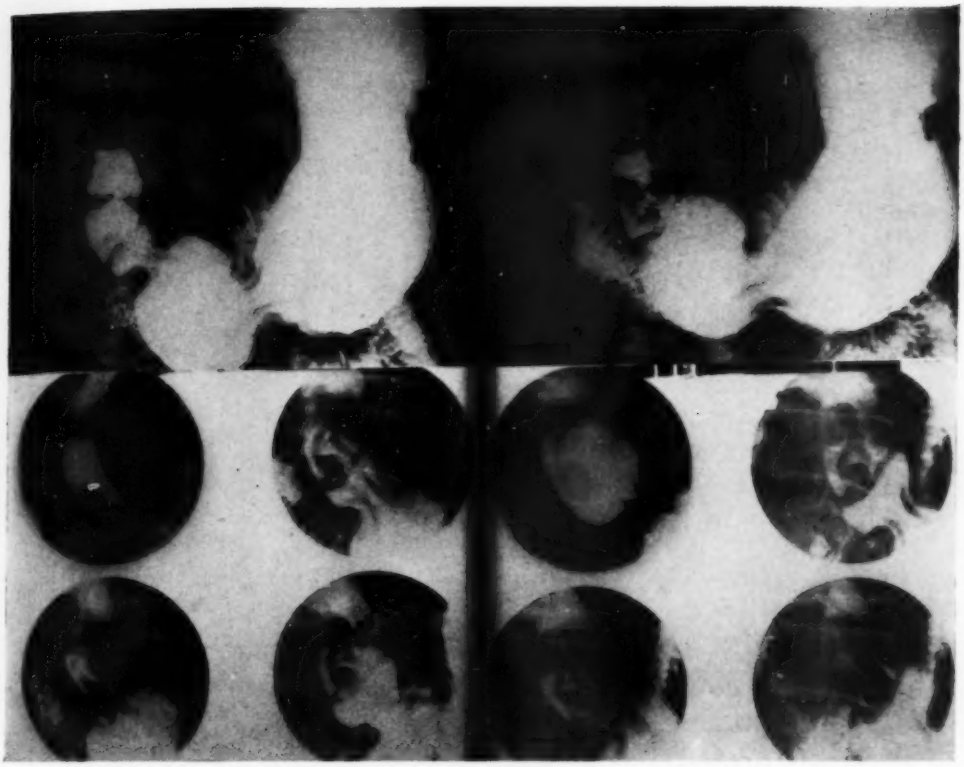

Fig. 9. Antral gastritis with pseudo polyp formation in a female, age 62. The patient also had cholelithiasis. At time of cholecystectomy the stomach was opened and a biopsy was done. Biopsy revealed that polyp was due to hypertrophy of rugae and a small submucosal nodule of pancreatic tissue.

(1) One case of generalized gastritis in which we thought, on x-ray examination, that two polyps were present, one of which was believed to represent a malignant process. Microscopically the resected specimen showed a gastritis. No polyps were present. The pseudo-polyps were due to localized hypertrophy of the rugae (Figs. 10 and 11).

(2) One case of generalized gastritis in which the x-ray diagnosis was probable gastritis, but a malignant process could not be ruled out. The pathological diagnosis was gastritis.

(3) Five cases in which the roentgen diagnosis was probable carcinoma of the prepyloric region. In all 5 cases microscopic study showed antral gastritis, in one instance of the atrophic type. This patient also had pernicious anemia and anacidity. In one case a duodenal ulcer was also present (Figs. 4, 5, 6, 12, 13).

(4) One case of gastric ulcer in the middle third of the lesser curvature of the stomach with considerable induration surrounding the crater, suggestive of carcinoma, associated, we believed, with antral gastritis. Microscopic examination showed a benign ulcer and an antral gastritis.

(5) Three cases in which our diagnosis was carcinoma of the prepyloric region but which proved to be hypertrophy of the pylorus with microscopic changes of antral gastritis. Two showed the change in the base of the bulb suggestive of pyloric hypertrophy, described by Kirklin and Harris (Figs. 7, 8, 14).

The difficulty of diagnosis of antral gastritis is shown by the fact that 8 cases

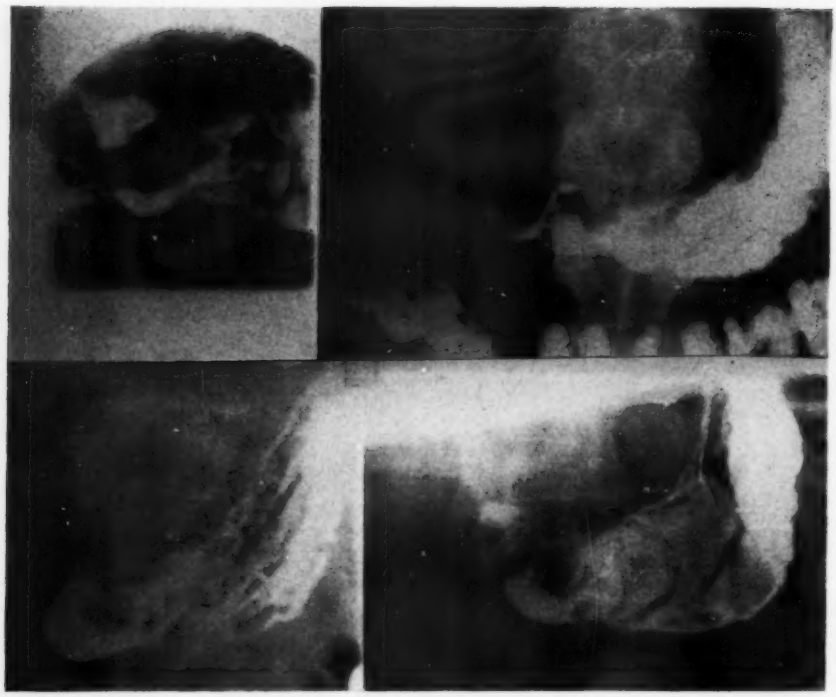

Fig. 10. Male, age 68. Note the two filling defects which are best shown on the two films on the left. It was felt that the filling defect in the mid portion of the stomach was due to a polyp, and that the one in the antral region might be due to a polypoid carcinoma. Resection was done, and the filling defects proved to be the result of localized hypertrophy of the rugae. No polyps were present. *Microscopic diagnosis:* gastritis. For photograph of specimen, see Fig. 11.

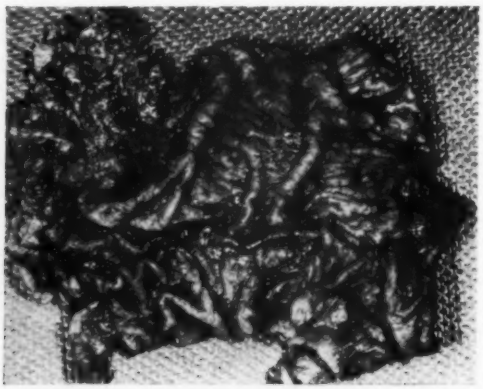

Fig. 11. Photograph of resected stomach from case shown in Fig. 10. The hypertrophied rugae were the cause of the two filling defects shown on the films.

in this study were diagnosed as a possible malignant growth of the distal end of the stomach but proved pathologically to be antral gastritis; 3 of these also showed a pyloric hypertrophy.

In our Clinic, over a thirty-month

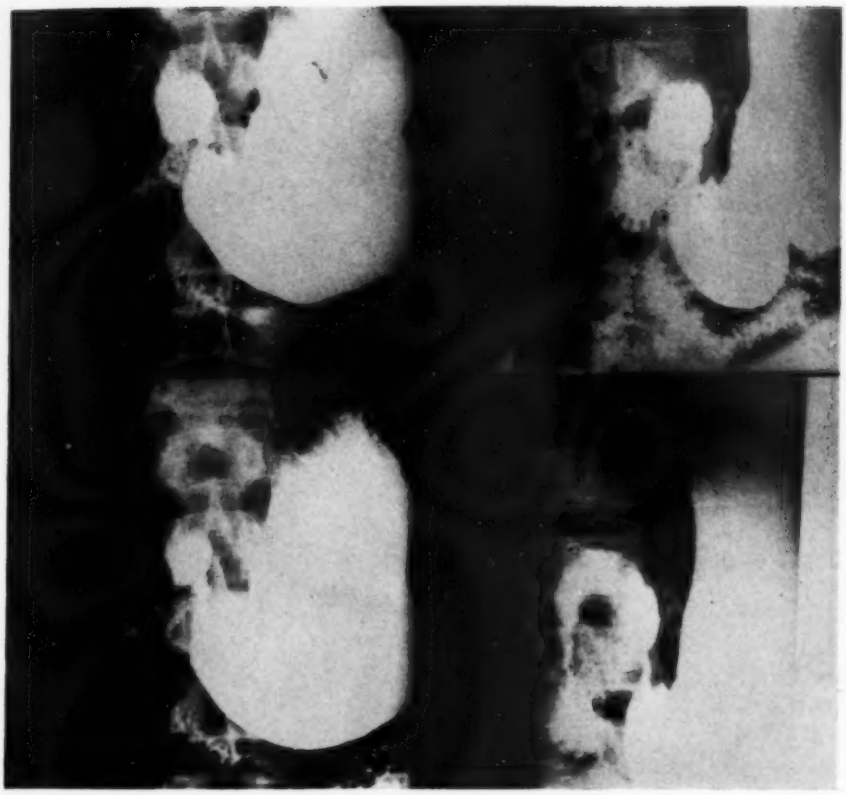

Fig. 12. Male, age 53, with pernicious anemia and anacidity. Carcinoma of the prepyloric region was suspected and resection was done. *Microscopic diagnosis:* atrophic gastritis. For photograph of specimen, see Fig. 13.

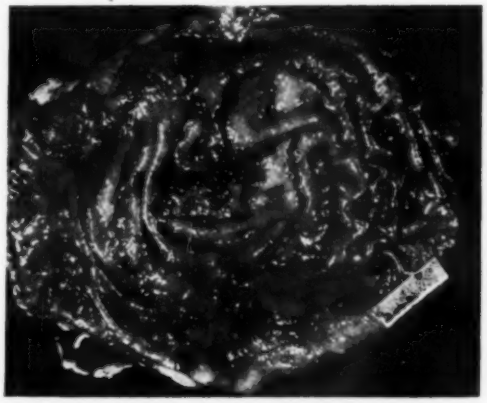

Fig. 13. Specimen from case shown in Fig. 12. *Microscopic diagnosis:* atrophic gastritis.

period, a diagnosis of antral gastritis without any other associated disease was made roentgenologically in a little over 1.0 per cent of the patients undergoing x-ray examination of the stomach. The condition is difficult to differentiate from

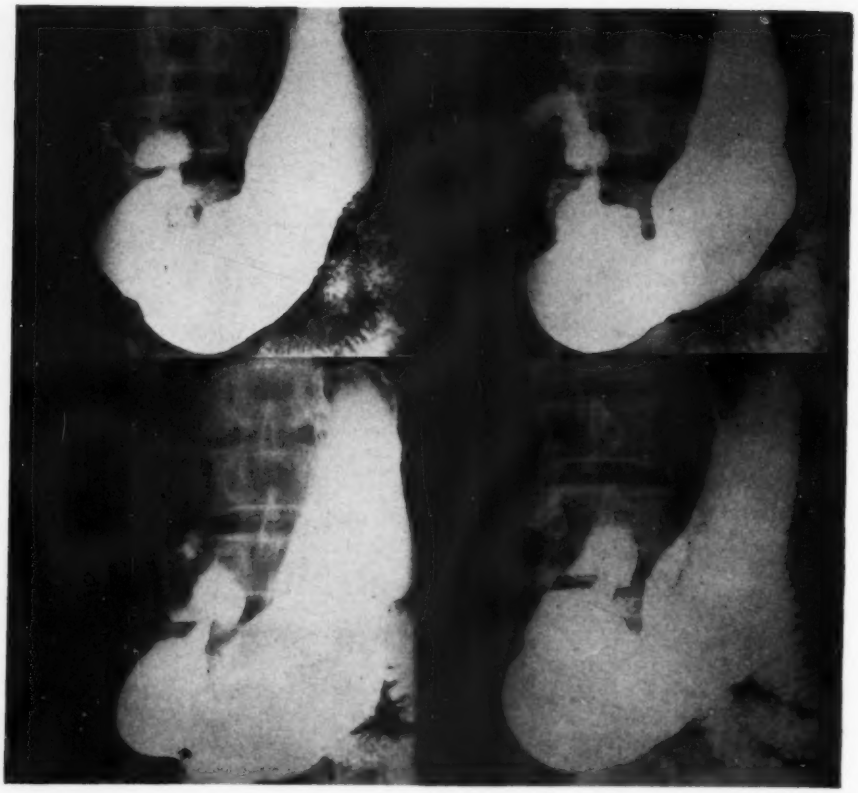

Fig. 14. Male, age 53. Since the antral narrowing changed very little on various films, it was felt that a carcinoma could not be ruled out. *Pathological diagnosis:* antral gastritis and hypertrophy of the pylorus.

prepyloric ulcer, hypertrophy of the pylorus, aberrant pancreatic tissue in the antral region, and carcinoma of the stomach. An effort should be made to differentiate antral gastritis from carcinoma in order to prevent needless surgery and its attendant mortality. In all cases, however, in which one does not feel he can absolutely rule out carcinoma, a gastric resection should be performed.

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SUMARIO

Gastritis Antral

La gastritis antral es una inflamación, de etiología desconocida, de la porción antral del estómago. Comienza probablemente en la mucosa, suele afectar la submucosa y puede extenderse a la serosa.

Las alteraciones roentgenológicas se deben principalmente a edema e infiltración de la mucosa y la submucosa y a espasmo, comprendiendo: (1) hipersecreción; (2) espasmo pilórico y antral y estenosis de la región antral; (3) acortamiento de la región antral debida a contracción de los músculos longitudinales; (4) hipertrofia de los repliegues gástricos, a veces con aspecto polipoideo; (5) rigidez de los pliegues de la región del antro; (6) irregularidad del peristaltismo en la región antral; (7) procidencia de la mucosa gástrica al duodeno; (8) hipertrofia de la musculatura pilórica; (9) retardo en el tiempo de vaciamiento gástrico debido a espasmo antral y pilórico; (10) a veces pequeños cráteres de úlceras en la zona afectada. Por lo general, sólo se observarán parte de esas alteraciones en un caso dado.

El factor más importante en la diferenciación de la gastritis, del cáncer es el patrón de las arrugas. En la gastritis, pueden seguirse éstas a través de la zona afectada sin brusca interrupción del patron de las mismas. Otros estados que hay que diferenciar son la úlcera prepilórica, la hipertrofia del píloro y el tejido pancreático aberrante.

En la serie de los AA. de 59 casos diagnosticados como gastritis antral, 2 fueron comprobados quirúrgicamente. Los otros 57 han sido mantenidos en observación durante dos años o más, sin signos hasta ahora de malignidad. Un diagnóstico de probable cáncer fué formulado en 11 casos que el patólogo clasificó después como benignos.

Roentgenologic Exploration of Gastric Rugae with Reference to the Diagnosis of Gastritis

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A REVIEW OF THE literature on the subject of gastritis is discouraging to the diagnostic radiologist. He learns that opinion is already generally established and that many investigators have found roentgen methods inaccurate and misleading. Gastroscopists claim that their procedure is more accurate in the study of mucosal disease, and accumulated evidence supports their position. Flood (1), however, has pointed out gastroscopic failures in the diagnosis of gastritis when the mucosa appears normal but there is inflammatory infiltration of deeper layers. Templeton (2, 3) believes that roentgen methods may be of greater value than gastroscopy in the detection of lesions affecting the submucosa and muscularis, and his views have been generally accepted. It appears, therefore, that the study of the gastritis problem should begin with joint effort and that under no circumstances should the accuracy of gastroscopy or roentgenology be judged, one in the light of the other. Radiologists should continue to assemble data that will allow a comparison of radiologic findings with gross and histologic evidence.

Most cases of radiologically suspected gastritis will not reach the pathologist. Such cases can be studied on the clinical level with presumptive diagnoses that may be derived from correlation of roentgen findings with clinical history, physical examination, laboratory study of the secretions, and gastroscopy. The clinical course of the disease, and its response following treatment, as well as repeated x-ray studies, might furnish material with which we can finally establish the accuracy of roentgen methods.

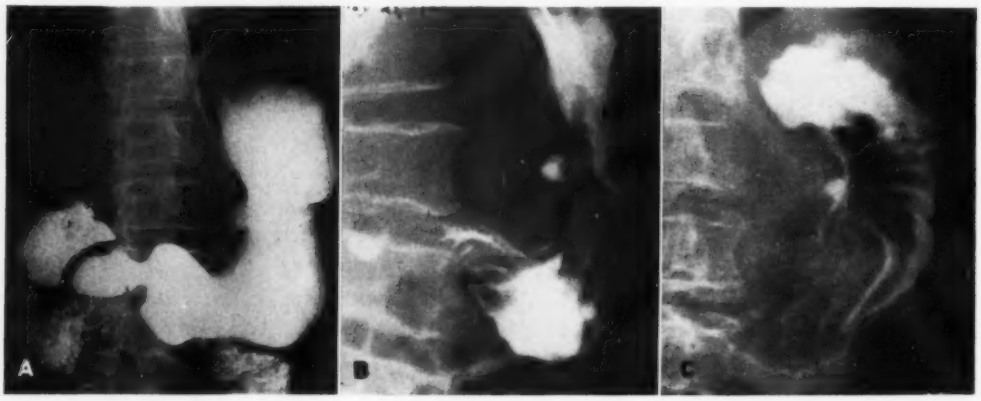

Fig. 1. A. Conventional view of the stomach. B and C. Mucosal detail views, showing converging folds.

It is our belief that more cases of symptomatic gastritis come to the attention of the radiologist than is generally realized. Haworth and Rawls (4) presented examples some of which were more spectacular than others. The cases with more pronounced deformities are difficult to differentiate

[1] From the Department of Radiology, Saint Luke's Hospital, Denver, Colo. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

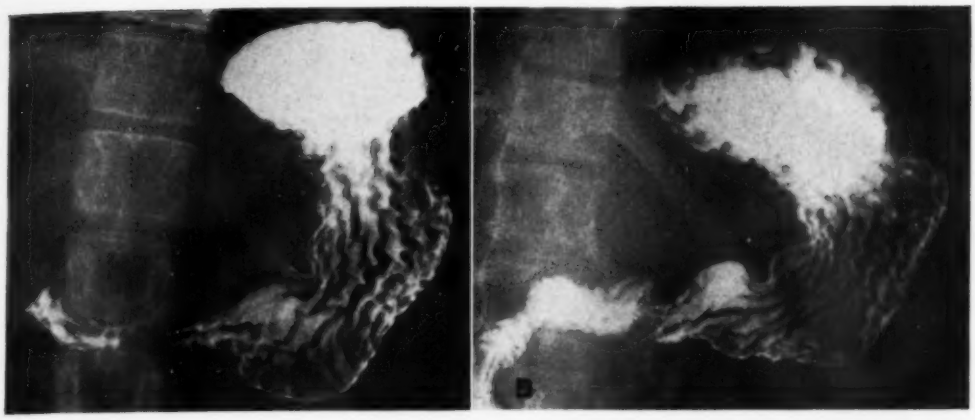

Fig. 2. A. Supine view following ingestion of thick barium mixture. B. Left posterior oblique view.

from carcinoma, while those with less striking alterations, to the conservative radiologist, may appear normal. With continued interest in the problem, we can work toward better understanding and we will eventually establish better diagnostic criteria.

TECHNIC

For a study of the gastritis problem, a roentgen technic that will give as much information as possible concerning the state of the mucosa and submucosa seems desirable. Careful fluoroscopy is essential and should include a study of gastric motility. Golden (5, 6) called attention to the mechanism of mucosal motility during antral systole, and its impairment by inflammatory states. Vaughan (7) emphasized the importance of Golden's observations in the gastroscopic and radiologic recognition of gastritis.

In the following description of our technic, reference to the esophagus and duodenum will be omitted. Particular emphasis will be placed on relief methods for studying the gastric rugae. Routine procedures need not be complicated by the introduction of balloons, gas-forming powders, or special barium preparations, although such procedures are helpful in some cases and may give information not available with regular methods. Conventional exposures (Fig. 1A) often disclose an abnormality. Special technics (Fig. 1B and C) can give additional information and suggest the diagnosis. Converging folds indicate that the lesion may be benign.

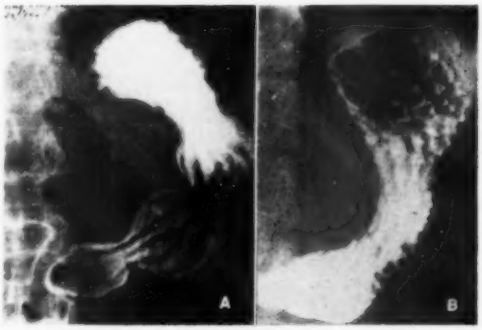

Fig. 3. A and B. Double contrast views.

The fluoroscopist should take a short history from the patient unless one has been provided by the referring physician. Such a history may direct attention to certain parts and indicate modifications of the routine technic. For this reason, the routine should not be too rigid, but should allow for the employment of special procedures that may lend clarification to an otherwise nebulous picture. The patient is asked to swallow 1 ounce of a fairly thick barium mixture while standing erect in the right anterior oblique position. For a better view of the stomach the fluoroscopist turns the patient, spreading the opaque material over the palpable portion of the stomach and attempting to get

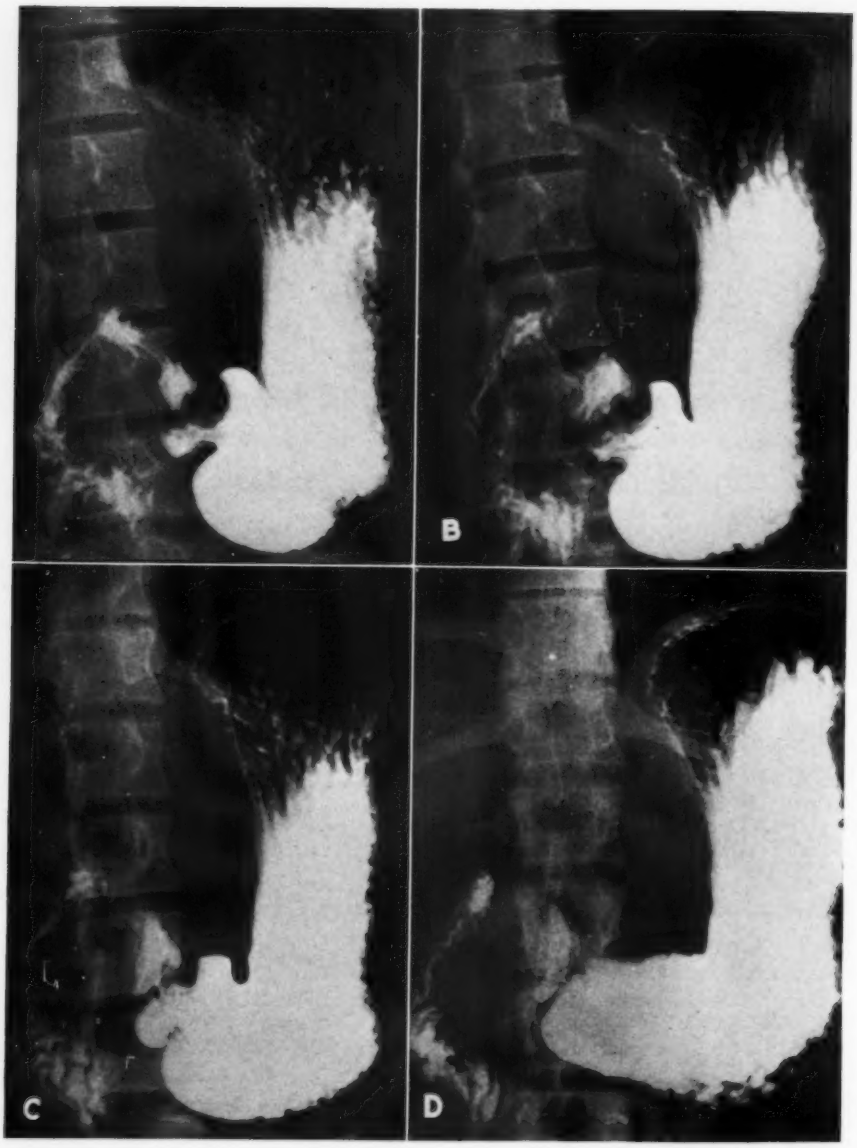

Fig. 4. A, B, C, and D. The same stomach in different degrees of obliquity.

some of it into the first part of the duodenum. The table is then tilted backward, and supine or oblique spot films are made after finding the degree of obliquity that demonstrates the structures best (Fig. 2). Excess barium gravitates up and posteriorly to the fundus, while air passes to the antrum and may enter the duodenum. Double-contrast views of the antrum and bulb are occasionally obtained and may be helpful in demonstrating mucosal irregularities (Fig. 3A). With the patient again in the erect position, air passes to the fundus and good double-contrast views of the upper stomach may be obtained (Fig. 3B).

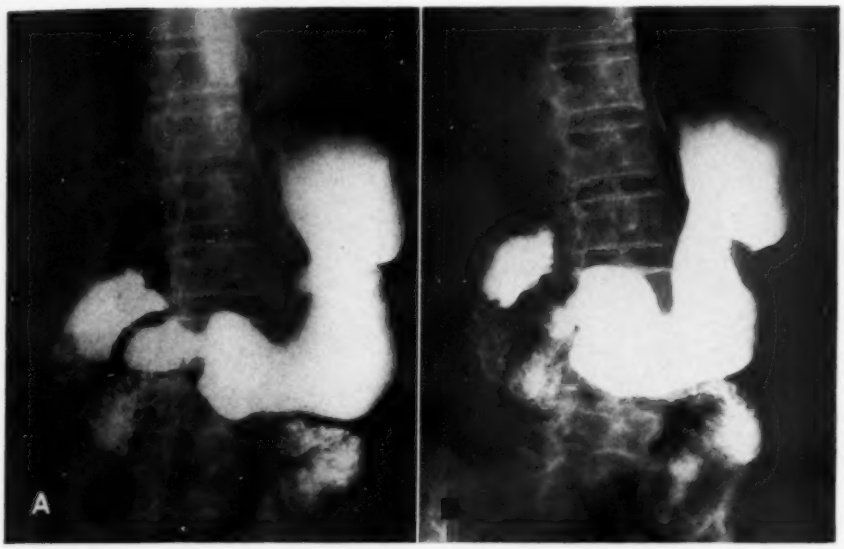

Fig. 5. A. Ulcer of lesser curvature shown in one projection. B. A more oblique projection, in which the ulcer is not visible.

The patient is then watched as he swallows 7 ounces of a thinner, more conventional barium mixture. Palpation and inspection are carried out in the usual way, and spot films are taken with and without pressure.

The table is again tilted backward, and the cardiac end of the stomach is studied. The patient is next rolled onto his abdomen, toward the examiner, permitting a better view of the curvatures, antrum, pylorus, and duodenum. Antral peristalsis can be observed in this position. The patient is then rolled to the right anterior oblique position, and that degree of obliquity that best demonstrates the duodenum is selected (Fig. 4A). Several radiographs are made in this more extreme right anterior oblique position. The patient is next moved slightly (roughly one-third the distance between this oblique position and the flat, prone position), and another film is exposed (Fig. 4B). He is again moved for another third of the distance, and a less oblique view is obtained (Fig. 4C) before finally obtaining one in the prone position (Fig. 4D). In these oblique prone and prone positions prepyloric rugae are sometimes demonstrated. The irregular and apparently purposeless arrangement of folds in the fundus is also seen. Radiographs made in different degrees of obliquity are important since mucosal deformities not visible in one profile may be shown in another (Fig. 5A and B).

A 14 × 17-inch supine exposure is made last. In addition to other well known reasons, this view is valuable for the amount of small intestine that it demonstrates. It may also afford good double-contrast studies of the antrum.

Efforts to produce double-contrast films are sometimes rewarding. Until recently, we relied on swallowed air, but since some patients cannot swallow air, we began to look around for a better but convenient method of demonstrating the lining of the stomach. We tried carbonating our barium suspension, in the hope that the amount of carbon dioxide released into the stomach would be sufficient to give good contrast. Using an ordinary home or household device for preparing carbonated water, carbonated barium was produced with relatively little effort. Most of the films made with this method were satisfactory (Fig. 6). It was hoped

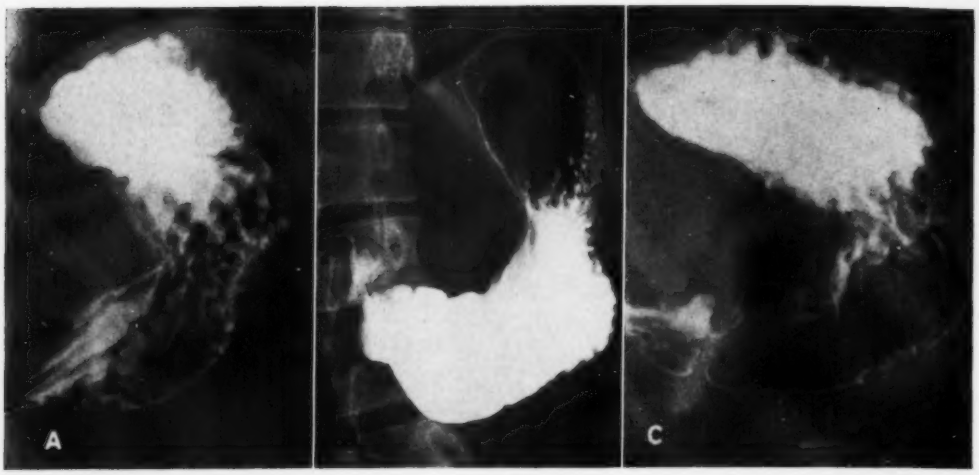

Fig. 6. A. Supine view obtained after one swallow of carbonated suspension. B. Prone view after six ounces of carbonated suspension. C. Left posterior oblique view after six ounces of carbonated suspension.

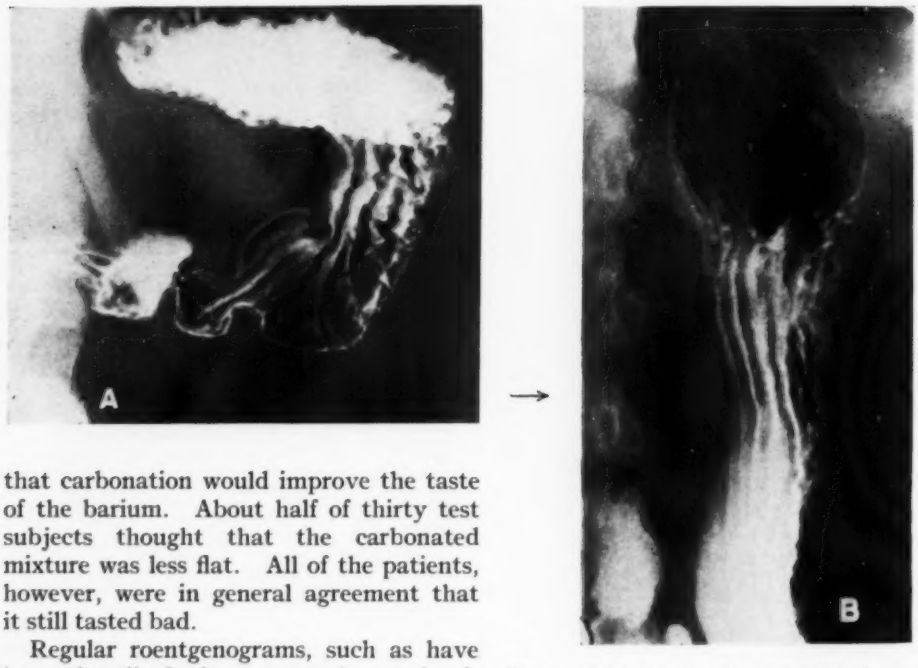

Fig. 7. Supine (A) and upright (B) views, showing mucosal folds.

that carbonation would improve the taste of the barium. About half of thirty test subjects thought that the carbonated mixture was less flat. All of the patients, however, were in general agreement that it still tasted bad.

Regular roentgenograms, such as have been described above, may be used advantageously in the study of rugae. If too much barium is used, however, much of the detail will be sacrificed, since distention with barium obliterates folds and obscures the relief. Too little barium, on the other hand, fails to fill significant lesions such as ulcer craters or diverticula. Pressure from cotton pads or other devices beneath the patient aid in furnishing good views of the mucosa on regular roentgenograms. The practice of making films in various oblique positions may make such

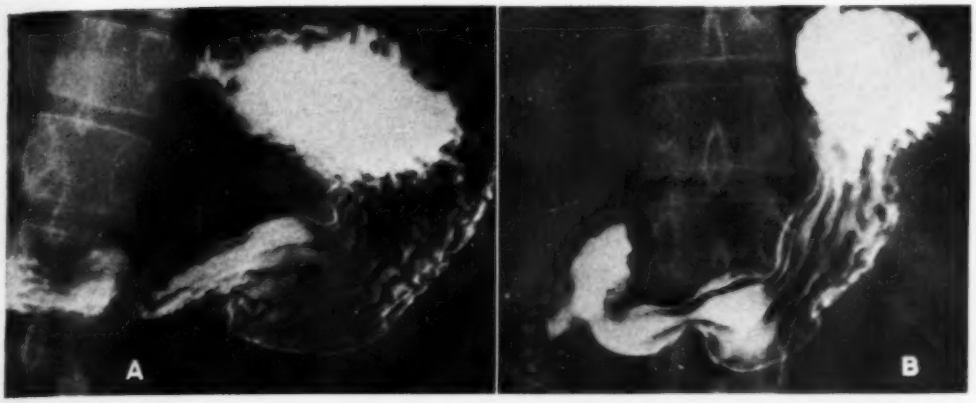

Fig. 8. A and B. Roentgenograms of two different individuals to show variations of normal fold pattern.

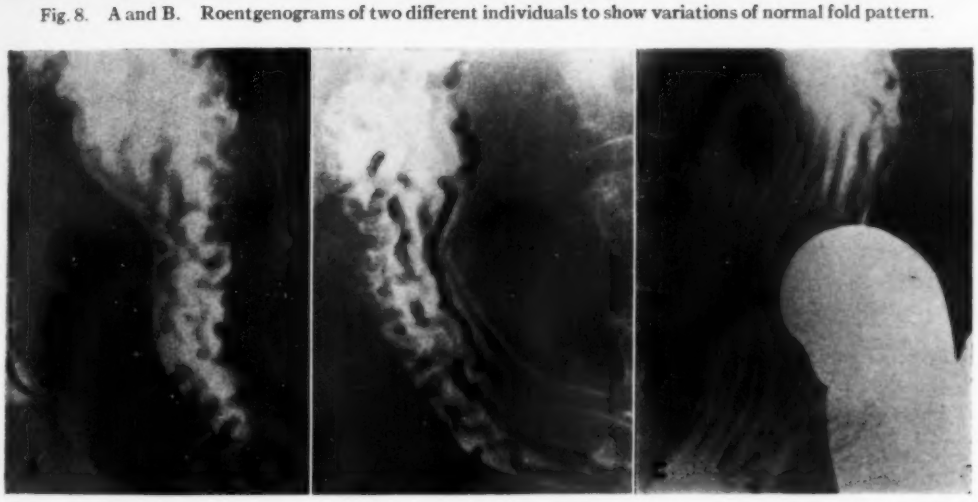

Fig. 9. Showing how change in position affects appearance of mucosal folds. A. Left posterior oblique. B. Prone. C. Upright.

devices unnecessary, since the spine sometimes rotates over the antrum, compressing it and revealing the antral rugae.

ROENTGEN ANATOMY OF GASTRIC RUGAE

The mucosal lining of the stomach is thrown up into numerous folds or pleats which seem to result from its confinement inside a muscular and serosal casing that is too small for it (Fig. 7). Examination at first fails to impress one with any regularity of rugal pattern, but anatomists have pointed out some characteristics that are constant. The border rugae run along and parallel to the lesser curvature. They represent the gastric pathway of Waldeyer and run from the true cardia toward the pylorus. The more lateral of these cross the axis of the stomach obliquely and often produce shallow indentations on the greater curvature. One of these, or a neighbor, is sometimes seen to divide before reaching the greater curvature, to produce an inverted "Y"-shaped configuration called the plica angularis.

The antral rugae vary in pattern. They may run in the direction of the lumen, but are more likely to be found obliquely situated, with many irregular components. Antral folds are even seen running transversely across the lumen and these are not necessarily abnormal.

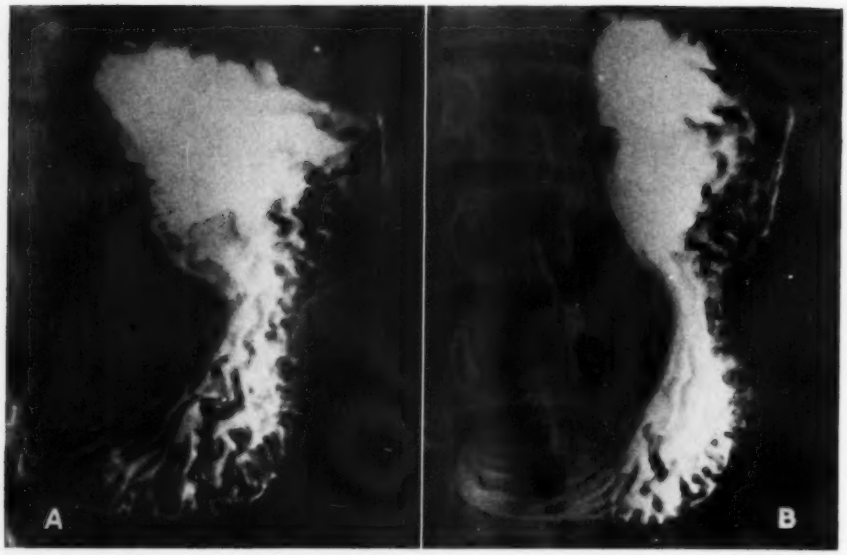

Fig. 10. Effect of pressure of adjacent organs as shown in (A) the supine and (B) prone positions.

Pattern in the fundus is often irregular except at the level of the true cardia, where the folds of the esophageal orifice may radiate outward in a stellate manner (9).

SOME CHARACTERISTICS OF MUCOSAL RELIEF FILMS

Mucosal relief films are of particular value in the study of the body and antrum. They are usually made while the muscularis is in a state of partial contraction or tonus, which is the resting state of the stomach. The mucosa appears more rugose on such views, the degree of folding and the size of folds varying widely in different healthy individuals (Fig. 8).

The appearance of the rugae in the same person changes with different positions. In films made with the patient supine, the rugae may be shortened and more tortuous, producing a krinkly pattern (Fig. 2). The obliquity of the projection also affects the appearance. The rugae appear crowded and foreshortened when the patient is rolled from the supine to the left posterior oblique position. In this latter position, air, when present, gravitates to the antrum and duodenal bulb (Figs. 3A, 6C, 9A). If there is enough air in the stomach, folds in these structures may be effaced, showing smooth mucosa (Fig. 11B). With little or no air, the folds appear quite natural. In the prone position (Fig. 9B), folds appear less tortuous and show the effects of pressure from adjacent structures. With the patient upright (Fig. 9C) barium falls to the antrum, stretching the folds in the body and straightening them, so that they appear close together and narrower. Pressure by the gloved hand, or by adjacent organs, can also affect the state of the mucosal folds. In the antrum, the mucosa may be rendered smooth by the palpating hand. It is more difficult, however, to obliterate folds in the body of the stomach, since the pressure required may be enough to cause discomfort. The effect of pressure by adjacent organs is demonstrated in Figure 10. The prone film is characterized by straightening and elongation of the folds. As they are stretched, they become thinner and closer together. The large pressure defect medially is produced by adjacent healthy structures.

Figure 11 demonstrates how completely folds may be obliterated by air. The same subject with air in the antrum looks

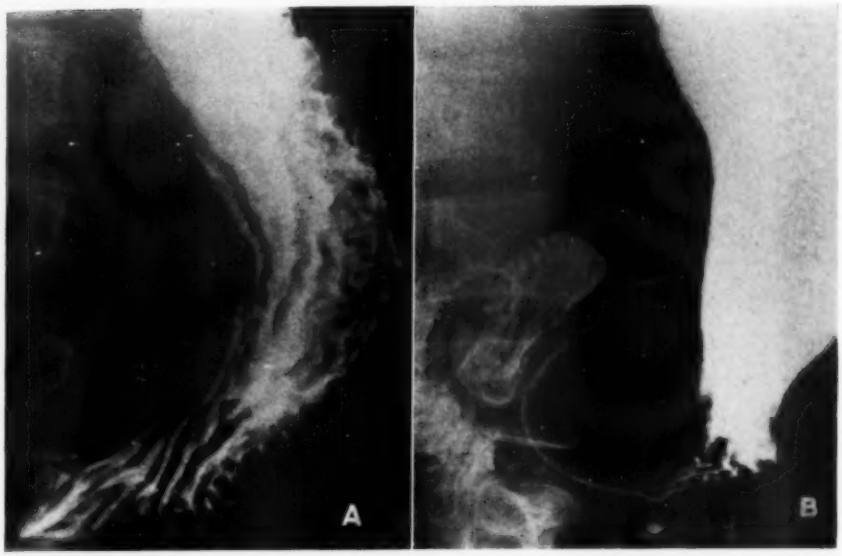

Fig. 11. Difference in appearance produced by excess air. A. Small amount of air. B. More air and more oblique projection.

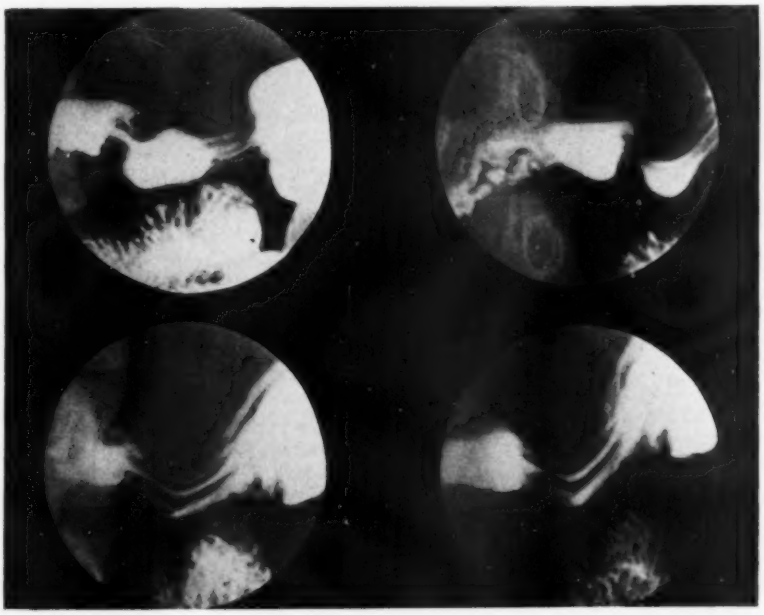

Fig. 12. Effect of peristalsis on mucosal folds.

different; distention irons out the rugae. They may be obliterated in the fundus in the same manner by standing the patient upright. The rugae on the anterior wall of the stomach are readily smoothed out by distention. The anterior wall is more distensible, and may be rendered quite smooth while the posterior wall remains

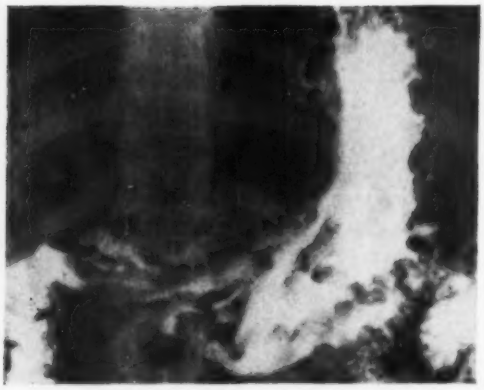

Fig. 13. Generalized hypertrophic gastritis.

ologist, and is common in the antrum, although it may affect any portion or all of the stomach (Figs. 13 and 14).

With swelling of the mucosa, submucosa, or both, the rugosity of the stomach usually becomes more pronounced. The folds may be higher, with deeper valleys between them, and they may appear thicker and farther apart (Fig. 15). They are often tortuous, and in some cases are so redundant that they hang into the lumen, producing bizarre deformities that are difficult to differentiate from neoplasm (Fig. 16).

The lining of the stomach may be so

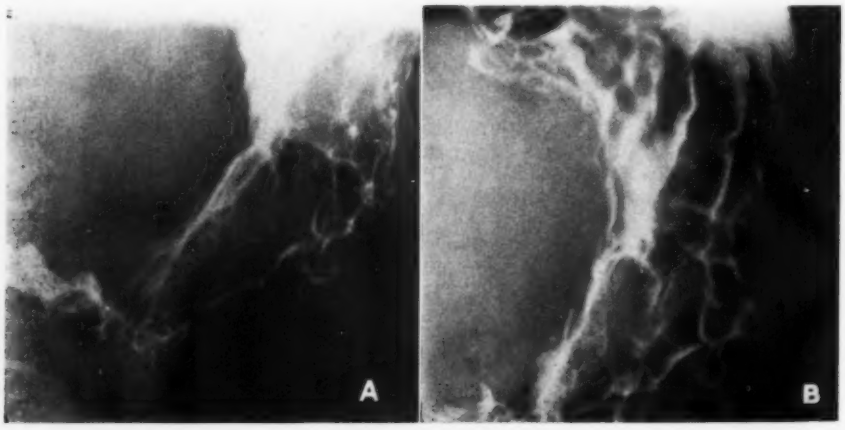

Fig. 14. A and B. Generalized gastric inflammatory reaction in a patient with perforation of an ulcer into lesser peritoneal cavity with subsequent peritonitis confined to lesser cavity.

deeply marked. Prolapse of redundant mucosa through the pylorus is seldom seen on supine films even though it is possible to demonstrate it in the prone position.

In spite of the apparent confusion of pattern that sometimes exists normally in the body and antrum, the peristaltic wave thins the mucosa as it moves toward the pylorus and arranges the tiny folds neatly parallel to one another (Fig. 12).

X-RAY FINDINGS IN GASTRITIS

The deformities of the stomach lining that appear secondary to inflammatory infiltration may be localized or generalized. The local type is more familiar to the radi-

thick that it buckles into the lumen in a manner suggestive of polyposis or neoplasm, and in some extreme cases actual polyps may exist. Prolapse of thickened redundant mucosa through the pylorus is common and, whenever seen, probably represents a manifestation of chronic gastritis. Figure 17 demonstrates hypertrophic redundant antral mucosa with prolapse. The folds throughout the stomach are swollen. Extreme thickening and rigidity of the stomach lining are sometimes seen without rugosity (Fig. 18A and B). The mucosa appears smooth and stiff, with shallow folds and almost absent peristalsis. The patient in this case presented a long history of dyspepsia, usually

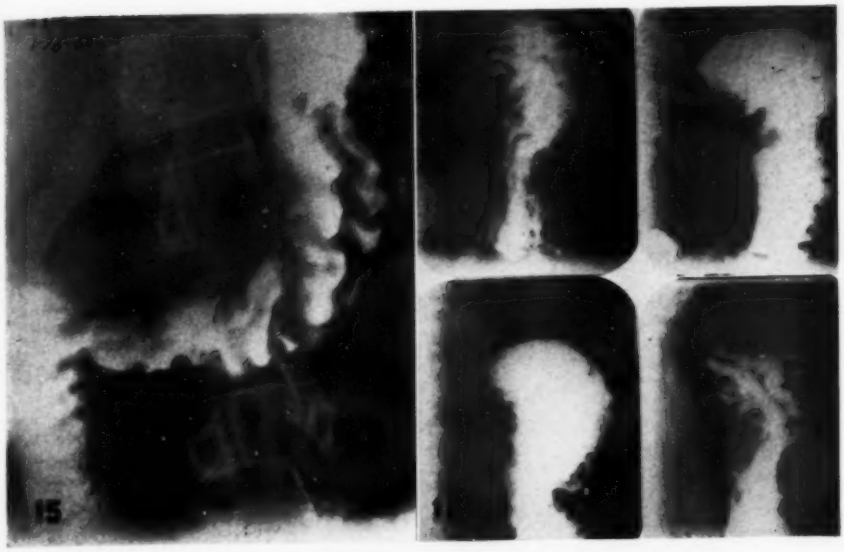

Fig. 15. Hypertrophic gastritis.
Fig. 16. Proved gastritis. Films on the right show defects resembling neoplasm.

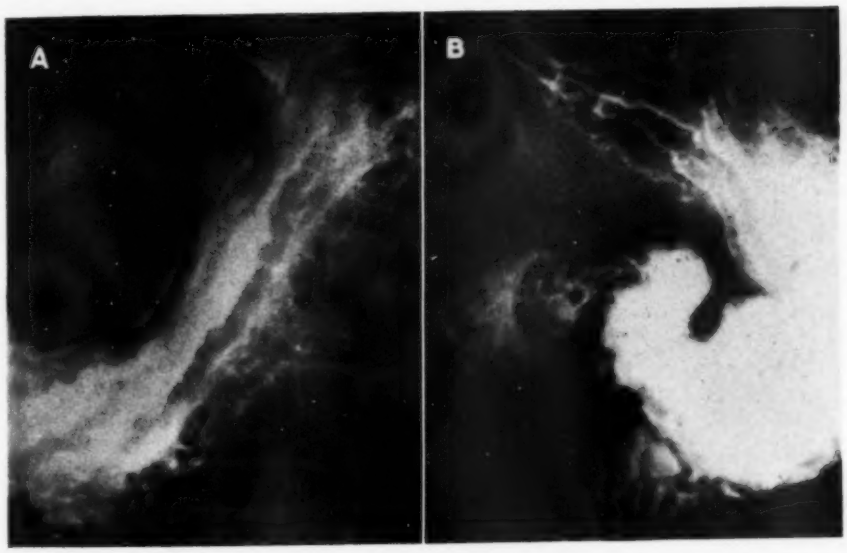

Fig. 17. A and B. Hypertrophic gastritis showing redundant mucosa and prolapse.

brought on by dietary indiscretion, alcoholic indulgence, and emotional distress. At the time of this study, he complained of rhythmic attacks of intense pain in the left upper part of the abdomen. Between attacks there was a steady ache, which could be relieved by milk and cream. On fluoroscopy, peristalsis at first was conspicuously absent, later sluggish. With the presence of more barium, emptying contractions became more powerful, and when they reached the antrum, there was pain. The rhythmic pains of which the patient complained were found to be syn-

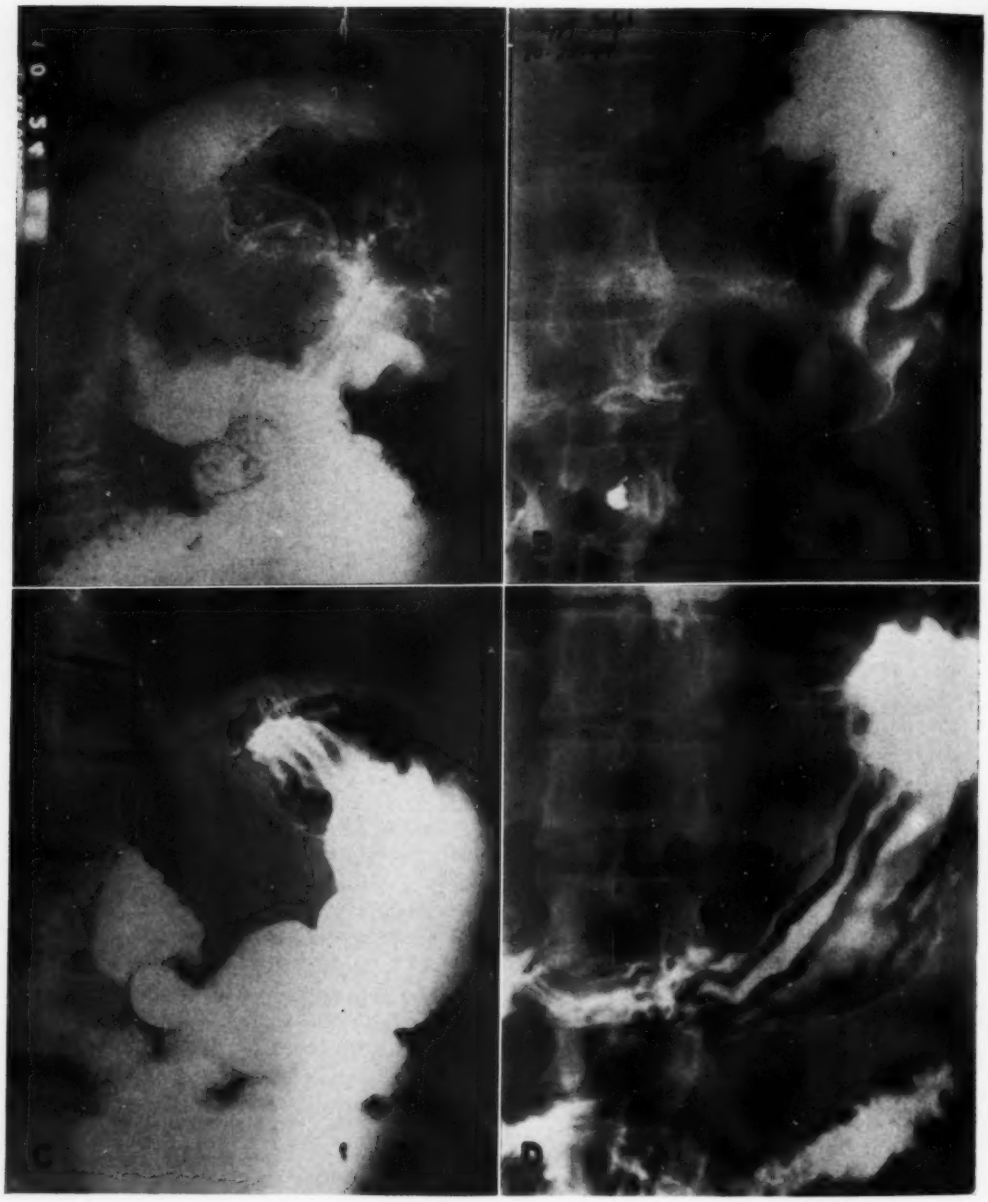

Fig. 18. A and B. Gastritis showing stiff, thickened, smooth mucosa. C and D. Same patient following treatment. Fold pattern is normal.

chronous with deep peristaltic waves. Figure 18C and D shows the appearance of the mucosa after three months of treatment. The x-ray picture as well as the clinical condition had improved.

A significant feature of the large folds seen in gastritis is their stiffness. The fluoroscopist may find swollen, edematous folds difficult or impossible to obliterate with the gloved hand. They may be

effaced with intragastric air, however, a fact that I believe is important in differentiating gastritis from neoplasm. Folds that are enlarged, stiffened, and distorted secondary to cancer or lymphoblastomatous infiltration usually remain so and are not as easily obliterated by distention. In gastritis, the peristaltic waves may fail to compress large stiff rugae into tiny folds.

A familiar characteristic of inflamed mucous membrane is hypersecretion. It might be recognized as excess thick fluid in the stomach at the beginning of the examination. Since so many apparently healthy individuals exhibit this sign, its presence is difficult to evaluate. Whenever it is present, but unassociated with other signs, it probably is not significant. Retained fluid is annoying to the fluoroscopist since it dilutes the barium and prevents him from obtaining good rugal relief films. The barium does not cling well to mucus-coated membrane, and films of poor contrast or incomplete detail result.

Irregularities or serrations along the lesser curvature are probably, in some cases, produced by thick mucous shreds. In other cases, the serrations represent mucosal erosions.

Other roentgen features of chronic gastritis may be demonstrated at fluoroscopy and include sluggish and ineffective peristaltic contractions (8). Motility of the gastric mucosa may be limited, with either delay or absence of antral systoles (5, 6, 7, 8). On films and at fluoroscopy, antral narrowing is seen and is considered by Golden (5, 6) to be the most common and most important sign demonstrable by roentgen methods. He believes that the narrowing is due to spasm with occasional hypertrophy of the pyloric muscle. Some other cases of antral narrowing, in our experience, are the result of fibrosis of the mucosa, submucosa, or entire stomach wall, and appear to be the outcome of long-standing severe inflammatory disease. In the patient shown in Figure 19, the same deformity was seen at several different examinations, and there was no free acid. At surgery, the antrum and pylorus were narrow and stiffened. The pathologist reported chronic inflammatory change with fibromatosis of the entire stomach wall. The mucosa was atrophic, but there was no evidence of cancer.

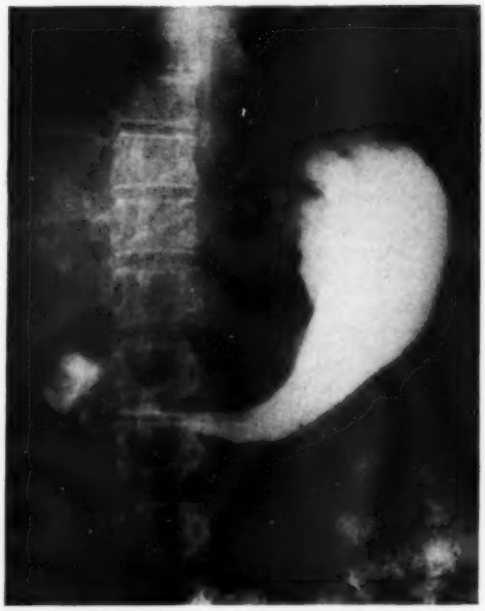

Fig. 19. Gastric fibromatosis simulating neoplasm.

SUMMARY

Roentgen methods have been considered inaccurate in the diagnosis of gastritis. We believe that with continued interest in the problem by radiologists, better understanding will result, and better diagnostic criteria will become available. Radiologists should continue to accumulate data that will allow a comparison of radiologic findings with gross and histologic evidence.

A method for studying gastric rugae has been presented. Normal rugal anatomy is described and an attempt is made to show how inflammatory disease might alter the appearance of mucosal folds.

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SUMARIO

Exploración Radiológica de las Arrugas Gástricas con Referencia al Diagnóstico de la Gastritis

Para el estudio de la gastritis, conviene contar con una técnica roentgenológica que facilite la mayor información posible acerca del estado de la mucosa y la submucosa. La roentgenoscopia cuidadosa es indispensable y debe comprender un estudio de la movilidad gástrica. La técnica de examen aquí descrita permite hacer observaciones y tomar radiografías en varias posiciones a continuación de la ingestión de una mezcla bastante espesa de bario y de otra más clara de la forma más usada. Las radiografías en relieve de la mucosa son de decidido valor en el estudio del cuerpo y del antro del estómago. Las alteraciones incidentes a una infiltración inflamatoria pueden ser localizadas o generalizadas.

Cuando hay edema de la mucosa o la submucosa, o de ambas, la rugosidad del estómago suele volverse más pronunciada. Los pliegues pueden ser más altos, con depresiones más profundas entre ellos, y pueden parecer más espesos y más separados. Son a menudo sinuosos, y en algunos casos, son tan exuberantes que cuelgan en la luz, produciendo caprichosas deformaciones que es difícil diferenciar de las neoplásicas.

La mucosa gástrica puede ser tan gruesa que se doble en la luz en una forma indicativa de poliposis o neoplasia, y en algunos casos extremados, puede haber verdaderos pólipos. El prolapso de la exuberante y espesada mucosa a través del píloro es común, y siempre que se observe, representa probablemente una manifestación de gastritis crónica.

Otras características roentgenológicas de la gastritis crónica, observables fluoroscópicamente, consisten en retardo e ineficacia del peristaltismo y estenosis del antro.

Speculations Concerning the Probable Evolution of Chronic Gastritis[1]

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THEOREM

1. CHRONIC gastritis is a common, innocent disease which radiologically can closely mimic cancer of the stomach.

2. It is frequently but not always possible to differentiate these two conditions radiologically.

3. The radiologist and gastroscopist must assume a large portion of responsibility for the morbidity and mortality of surgical intervention in gastritis mistaken for cancer. This should be charged to the statistics for cancer of the stomach.

4. The low five-year free-from-disease surgical yield for cancer of the stomach places a tremendous responsibility on the gastroscopist and radiologist to differentiate chronic gastritis from cancer of the stomach.

5. Chronic gastritis is the shortest and simplest term suggested to be uniformly applied to this disease.

6. Chronic gastritis passes through phases of increasing and progressively irreversible pathologic changes in the stomach. Manifestations of these phases in such order may be indicated by: prolapsing gastric mucosa, antral gastritis, generalized gastritis with a prominent antral phase, and antral and pyloric fibrosis and hypertrophy (the latter frequently called benign hypertrophy of the pylorus in adults).

SPECULATION

Chronic gastritis (hypertrophic gastritis), a common, innocent disease which can be confused radiologically with cancer of the stomach, should be an object of the keenest interest on the part of all practitioners of medicine. It should be uniformly designated by a simple, short term, as "chronic gastritis," and not obscured by a multiplicity of confusing names perpetrated by the pathologist, gastroscopist, and radiologist. Whenever possible, this and other disease processes should be demonstrated by more and clearer radiographic reproductions, illustrations, photomicrographs, and concise descriptions to aid the student in his pursuit of knowledge.

Our initial interest in chronic gastritis, arising from some of our own problem cases, was doubled when we encountered numerous articles, especially by gastroscopists but also by radiologists, dealing with the erroneous radiologic interpretation of gastritis as gastric cancer (3, 17, 19, 24, 37, 46). In all of these instances, the pathological diagnosis was in essence chronic gastritis (hypertrophic gastritis). The radiographic illustrations showed the vast majority to be lesions in the antral region, which could be classified as antral gastritis with prolapse, generalized gastritis with a prominent prolapsing antral aspect, and benign hypertrophy of the pylorus in the adult. In a smaller number there was isolated rugal hypertrophy elsewhere in the stomach, as the cardia and greater curvature, without evidence of prolapse or antral involvement. Other articles, purporting to deal with benign hypertrophy of the pylorus in adults, showed examples of antral gastritis with prolapse; dissertations on generalized gastritis denied the occurrence of prolapse though its presence was demonstrated in the illustrations, and what appeared to be benign hypertrophy of the pylorus in adults was designated as habitual pylorospasm and by other terms.

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[1] From VA Hospital, Denver, Colo. This paper is a rewrite of one of the same title presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

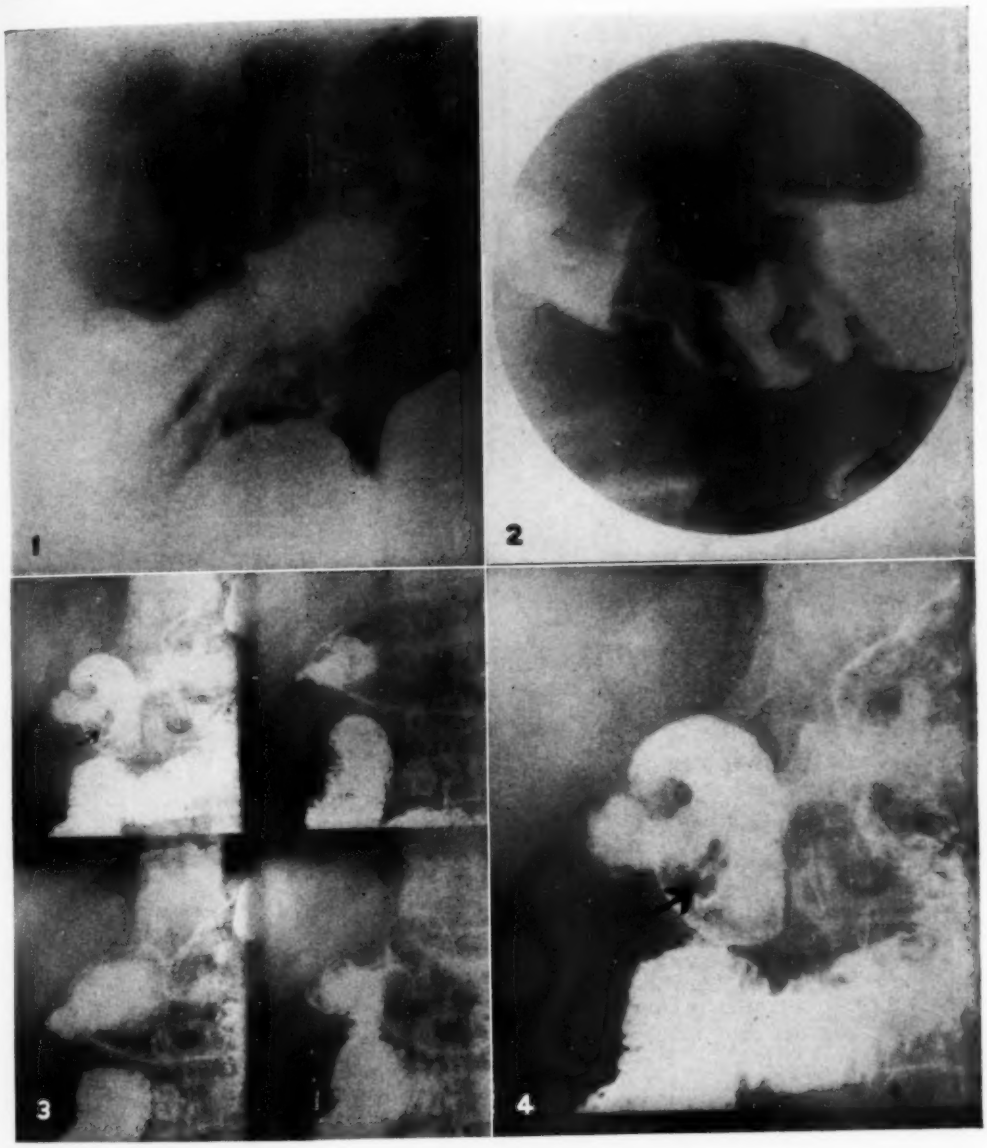
With the preceding observations in mind, along with the fact that a high percentage of gastric cancer develops in the antral and pyloric regions of the stomach and the fact that most of the radiological misidentification of gastritis for cancer has been in this region, we have formulated the speculation that chronic gastritis may reveal itself by the following radiological manifestations from its earliest and mildest—perhaps reversible—changes to the more profound and irreversible anatomical-pathological changes: prolapsing gastric mucosa → antral or generalized gastritis with prolapse → benign hypertrophy of the pylorus in adults. It is granted that this concept conveniently ignores isolated hypertrophy other than antral, prolapse or antral gastritis associated with heart failure, hyperproteinemia, or allergy (32, 33). It is our opinion that these account for an insignificant minority of cases.

The cause of chronic gastritis is probably the same as that of gastric ulcer, duodenal ulcer, and duodenitis, as these conditions are associated with great frequency. The neurogenic element is probably of great importance. Individuals so afflicted are generally high-tensioned, heavy drinking or smoking, or both, with gastric analyses ranging from extremely high acid levels to zero (9, 45).

Phase I: Prolapse of the Gastric Mucosa (*1, 2, 3, 9, 16, 17, 32, 45*): Innumerable articles have been devoted solely to prolapse of the gastric mucosa. The characteristic radiolucency in the base of the bulb is familiar to all and has been described as "mushroom" or "umbrella-like," and likened to the appearance of the explosion of the atomic bomb (17, 32, 38). It is probable that only the most minor infiltration of the rugae produces sufficient stiffening to cause them to be propelled through the pylorus and into the base of the bulb. In pure prolapse, one does not see the disconcerting antral defects mistaken for cancer. Prolapse is of interest to us because it is seen in antral and generalized chronic gastritis; a similar but causally different change is observed in adult pyloric hypertrophy. It was probably the common finding of radiolucency in the base of the bulb which led us to speculate upon a relationship of these conditions.

Phase II: Antral Gastritis and Generalized Gastritis with a Prominent Antral Aspect (*8, 18, 19, 31, 51*): Antral gastritis and generalized gastritis with prominent antral involvement produce gastric cancer-resembling defects sufficient to make the radiologist extremely concerned in a significant number of patients. These changes, and prolapse of the type of which we are speaking, probably do not occur in a short period of time, but are more likely the result of repeated insults to the gastric mucosa, particularly in association with outright gastric (Fig. 1) or duodenal ulceration. The repeated trauma to the infiltrated mucosa and submucosal layers by the peristaltic churning of the muscular antrum creates a vicious cycle wherein peristalsis produces more injury and more injury produces increased peristalsis (35, 51). There is often excessive secretion of mucus and fluid, diluting the contrast medium used for radiological examination. Superficial ulceration may take place, but this usually cannot be identified with certainty by radiological methods. The end-result is such swelling, edema, and infiltration of the mucosa that on any single radiograph of the antrum defects are present which may resemble any fungating neoplasm that occurs in this area (Fig. 2).

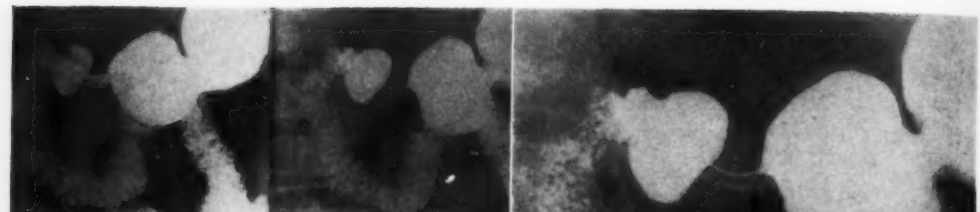
Repeated examinations are frequently necessary, with the generous use of serial and spot filming, and other maneuvers, such as the Hampton technic of the left posterior oblique position, to fill the barium-coated antrum with gas (Fig. 3), before a reliable diagnosis of antral gastritis can be made. These will show that the defects due to the edematous, infiltrated rugae are thickest, and the space between them greatest, early in antral systole (Fig. 4), unless the picture is obscured by distention of this region with too much opaque medium. In mid-antral systole, with just



Figs. 1–4. Case I

Fig. 1. Gastric ulcer associated with profound antral gastritis seen in subsequent illustrations.
Fig. 2. Gross antral defects resembling gastric cancer. Note associated prolapse.
Fig. 3. The barium-coated, gas-filled antrum shows no neoplasm. Hampton technic.
Fig. 4. Detail from Fig. 3. Question of abortive intussusception due to rugal stiffening.

the right degree of filling or with slight compression, the enlarged rugae will present a very ragged peripheral contour and also peep through the opacified antrum as radiolucent filling defects. At the completion of antral systole, with the antrum reduced to almost a straight tube of small caliber, the infiltrated rugae and the spaces between them, although reduced in size, may each be several millimeters in width



Figs. 5–6. Case II

Fig. 5. Smooth annular antral defect of adult pyloric and antral hypertrophy and fibrosis, with slight variability in caliber.

Fig. 6. Detail from Fig. 5. A single large rugal fold passing through the hypertrophied and fibrosed antral region.

(12). They attempt to orient themselves in straight parallel lines but, because of their stiffness, usually appear as irregularly arranged radiolucent blobs. They are almost invariably driven to prolapse into the base of the bulb. During this cycle, careful fluoroscopy and sufficient serial films will demonstrate the complete inconstancy of these defects. Other carcinoma-differentiating aids are the following: no mass is palpable corresponding to the rather large defect observed; peristaltic contractility, although sometimes perverted, will eventually pass through all defects; the caliber of the lumen shows variability.

The folds tend to remain under a degree of compression which would obliterate folds considered within the normal range. Folds which show such infiltration tend to become less mobile and more "tacked down" to the muscularis mucosae (51). The antral squeezing and churning cause further injury. This produces erosion and raises the tone of the muscularis propria. If this is repeated sufficiently long, chronic gastritis may evolve to its next phase.

Phase III: Benign Hypertrophy of the Pyloric and Antral Muscles in Adults (Fig. 5) (3, 9, 10, 16 26, 48, 49): Numerous theories are propounded to explain benign hypertrophy of the pyloric and antral muscles in the adult: endocrinopathy, neurogenic influences, and a hold-over of hypertrophic pyloric stenosis of infancy. All of our patients were thirty-five years of age or older; we have found no hint of the condition in examining the gastro-intestinal tracts of several thousand young males under the age of thirty-five. These observations on age incidence are supported by the literature, in that the vast majority of patients in whom this condition is described are thirty-five years old or over. The question may legit-

imately be raised, why is it that so few examples, if any, are seen at an earlier age if the condition is a hold-over from an undiagnosed childhood type of pyloric hypertrophy with its known proclivity to occur in the male sex? The gross examination of our material indicates that although the pyloric muscle is enlarged the volume of the defect is contributed for the most part by a marked thickening of the antral muscle extending proximally a matter of at least 2 or 3 cm. Microscopically, this thickening consists mainly of spindle cells of either smooth-muscle or fibroblastic origin, or both. Special stains have not aided in the differentiation. The mucosa shows inflammatory changes with hypertrophy and atrophy combined. It is therefore thought that this phase would better be designated as adult pyloric and antral hypertrophy and fibrosis, which implies the presence of some inflammatory change.

After months or years of an attempt on the part of the antrum to propel the thickened, stiffened folds of prolapsed mucosa, antral or generalized gastritis, through the pylorus, it would seem that there would occur oft-repeated episodes of erosion and inflammation. This would result in hyperperistalsis and stimulation of the muscularis propria to raise its tone until the final result of antral muscle hypertrophy, fibrosis, and mucosal atrophy ensued (Fig. 6). This is evidenced in our own cases and reports of others with sufficiently clear illustrations from which to determine this. Instead of four to seven delicate folds seen at antral systole, only one or two very coarse folds are in evidence. The annular defect in this situation very closely resembles annular carcinoma of the pylorus. It may be differentiated by the radiolucency it is capable of producing in the base of the bulb, and by the fact that its proximal end is rounded and smooth. Both ends of this defect have been compared to the appearance of the cervix uteri. Attention has been called to the fact that there is an unsupported area of mucosa between the

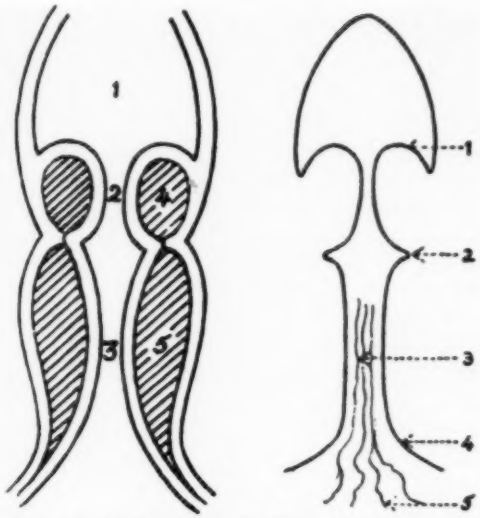


Fig. 7. Semidiagrammatic illustration of hypertrophied antrum and pylorus, and radiological profile showing area of mucosal pits. 1. Duodenal bulb. 2. Pyloric canal. 3. Antral lumen. 4. Pyloric sphincter. 5. Hypertrophied prepyloric circular muscle fibers.
Courtesy of A Text-Book of X-ray Diagnosis by British Authors, 1st ed., Vol. 2, p. 103.

hypertrophied pyloric and hypertrophied antral muscles (Fig. 7). This area of mucosa tends to herniate as a pseudodiverticulum between these muscle bands, and, on gastro-intestinal examination, these pits fill with barium and are frequently mistaken for pyloric ulcers on the greater and lesser curvatures (49). The erroneous diagnosis of prepyloric ulcer with pylorospasm or of ulcerating annular carcinoma of the pylorus is thus entertained (Fig. 8).

Aids in the exclusion of carcinoma are: the smooth proximal and smooth distal ends of the filling defects; the absence of a palpable mass corresponding to the defect; the variability in lumen size, as evidence of contractility; the absence or presence of low-grade obstruction rather than the wide-open patulous pylorus frequently seen in carcinoma in this region. In all patients in whom we suspect hypertrophy and fibrosis of the pyloric and antral muscles, we make ample re-examinations and spot films in an attempt to fill these mucosal pits. When we are able to do this, we feel that we have additional support

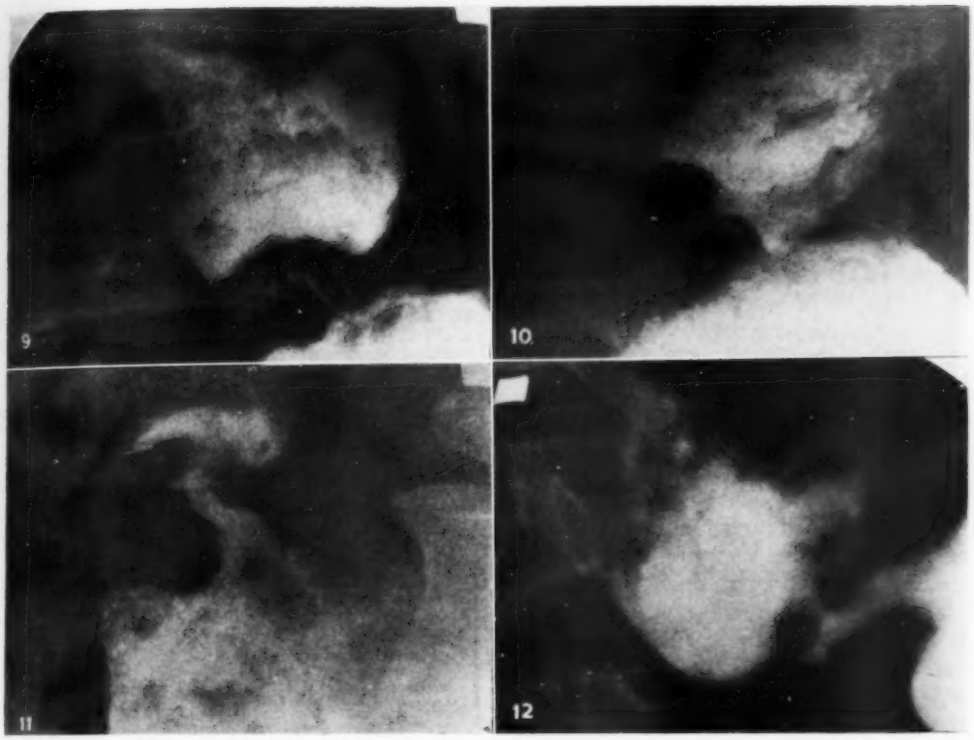
Fig. 8. Case III. Mucosal pits superiorly and inferiorly (not well shown). Proved operative case of antral and pyloric hypertrophy and fibrosis.

for the exclusion of carcinoma. Even so, cancer may be a diabolical deceiver (Figs. 9–12).

EPILOGUE

It is evident from the foregoing discussion that chronic gastritis does produce organic changes recognizable radiologically (34) and that these changes can be mistaken for gastric cancer. This has been beneficial, in that much greater interest has been focused on this problem. In our own group, we have interpreted gastritis as cancer and cancer as gastritis. We have also identified gastritis where the diagnosis on more than one gastroscopic examination had been cancer. Operative intervention has been held in abeyance in several of these instances and gastritis has been proved at autopsy following death due to causes other than those being considered, or the observation time has been sufficiently long to negate the possibility of a malignant lesion.

In the vast majority of cases the gastroscopic and radiologic diagnoses have been in agreement; these two methods of examination are complementary and supplementary to each other. When they are in disagreement, with one diagnosing the lesion as cancer and the other as gastritis, the problem is serious. The surgeon and the internist are at the equator between these two poles of opposite opinion. In one such hypothetical case, it is decided to perform an exploratory or explanatory laparotomy. The abdomen is opened, and on external palpation of the stomach the surgeon states that no cancer is present. It has been shown, however, that this method of examination is inadequate and that cancers of the stomach may be missed by such a maneuver (13, 48). Therefore, the stomach is opened and a suspicious area is seen from which a specimen is removed for frozen section. The pathological diagnosis of "no cancer seen" is returned; shall the stomach and the abdomen be closed? Shall a resection be done, and if so, how extensive? An extensive resection is performed; and the patient succumbs on the fourth post-



Figs. 9–12. Case IV

Fig. 9. Narrowed canal; rounded defect at base of bulb. Right anterior oblique.
Fig. 10. Narrowed canal; rounded defect at base of bulb. Left anterior oblique.
Fig. 11. Narrowed canal; barium-filled pits on each side. Left anterior oblique.
Fig. 12. Its cruel true nature revealed. Gastritis hoped for; ulcerating pyloric cancer detected only after multiple studies.

operative day. The specimen shows gastritis and no cancer. This is a medical defeat.

A significant factor in this dilemma is the present attitude of both the medical profession and the public toward cancer. This word has become a hobgoblin with which we have frightened ourselves and the public. Both groups have mistaken size for the chronological evolution of cancer, regarding a small lesion as early, a large lesion as late or advanced. This most certainly cannot be substantiated in cancer of the stomach. The diagnosis of cancer implies that something must be done with haste and this is justifiable in some instances. It is not justifiable when the problem is one of differential diagnosis between cancer and gastritis. The low five-year clinically-free-from-disease survival in operable cancer of the stomach, plus the significant mortality and morbidity from extensive stomach resection in expert hands, supports this conclusion. Our diagnoses should be unequivocal: chronic gastritis—organic gastric lesion of unknown etiology—cancer. The reduction of the middle zone is the one toward which our most strenuous efforts must be bent (44).

We beg the privilege of personally recalling the events surrounding two patients examined years ago. A middle-aged female on two consecutive upper gastrointestinal studies showed polypoid defects in the stomach from the cardia to the pylorus; the diagnosis was inoperable gastric carcinoma. The patient died of

cancer of the stomach eight and one-half years later. The second patient was an elderly male with a radiological report from a large Eastern hospital: "cancer of the stomach, a rather large antral defect corresponding to which a not too palpable mass could be felt." Two upper gastrointestinal examinations led to a diagnosis of organic antral defect, *not cancer!*"—in retrospect, an unconscious diagnosis of antral gastritis before the examiner was cognizant of the importance of this lesion. This patient was living and well ten years after examination.

Perhaps the greatest contribution which could be made on this particular subject would be the formation of a registry which could collect and compile complete information, including the morbidity and mortality, on those cases diagnosed gastroscopically and/or radiologically as gastric cancer but found at surgery or autopsy to be chronic gastritis. This morbidity and mortality should be charged to the statistics for gastric cancer and the true significance of chronic gastritis could then be evaluated.

NOTE: Mr. Jack Fason, Chief of Medical Illustration, VA Hospital, Denver, Colo., deserves sole credit for the technical quality of the accompanying illustrations.

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SUMARIO

Especulaciones Acerca de la Probable Evolución de la Gastritis Crónica

Cogítase que la gastritis crónica puede traducirse por las siguientes manifestaciones radiológicas desde las primeras y más leves (quizás reversibles) hasta las más profundas e irreversibles alteraciones anatomopatológicas: prolapso de la mucosa gástrica → gastritis antral o generalizada con prolapso → hipertrofia benigna del píloro en los adultos.

Es probable que la infiltración mínima de las arrugas gástricas produzca suficiente rigidez para hacerlas descender a través del píloro y a la base del bulbo duodenal. En la segunda fase, de gastritis antral o generalizada, el resultado terminal es tal inflamación, edema e infiltración de la mucosa que, en una sola radiografía del antro, el cuadro puede ser sumamente indicativo de neoplasia. El examen roentgenoscópico y las radiografías instantáneas en serie durante la sístole antral revelarán, sin embargo, una notable inconstancia en las deformaciones.

A medida que los infiltrados pliegues de mucosa pierden movilidad, pueden experimentar nuevas lesiones, con erosión e hipertonicidad de la muscularis propria. Si eso continúa por algún tiempo, la gastritis crónica puede pasar a su próxima fase: hipertrofia benigna de los músculos del píloro y del antro. El cuadro entonces puede remedar carcinoma anular del píloro, mas puede diferenciarse por la radiolucencia que es capaz de producir en la base del bulbo y por la lisura de los extremos proximal y distal del nicho.

Clinical Aspects of Gastritis and the Gastroscopic Findings[1]

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THE CLINICAL importance of gastritis has been more apparent with each new development in our diagnostic armamentarium. The improvement of technics in radiology, the greater interest in differential diagnosis of the vague disorders of the gastro-intestinal system along with the development of endoscopic and laboratory procedures, has led to more accurate interpretation and classification of gastritis. Despite great progress in the understanding of the pathology and recognition of various gastritides, there is much to be learned regarding the clinical significance of this group of disorders.

Gastritis occurs frequently. It was discovered by Schindler in 41.8 per cent of 1,000 patients studied gastroscopically in America (1). Other observers have found the incidence to be as low as 12 per cent of the patients examined (2). In spite of the frequency of its occurrence, gastritis is not so often of serious importance from a clinical point of view. In our experience, the most practical aspect of the disease is to be observed in those cases in which clinical or x-ray findings lead to a suspicion of gastric cancer. In this group of patients the process of making the proper decision as to definitive therapy frequently involves the utilization of all diagnostic technics available. The search for a correct diagnosis may include even surgical exploration.

In this paper, a number of cases will be presented to emphasize the confusing aspects of the problem. An effort will be made to evaluate some of the methods at our disposal in attempting to reach a correct diagnosis with the least possible damage to the patient.

Gastritis is classified most simply into three groups: superficial, atrophic, and hypertrophic. For the purposes of this paper, much of the discussion will be related to hypertrophic gastritis, since it is this group which presents the problems most frequently confronting the gastroenterologist and the radiologist. Superficial gastritis and atrophy, or atrophic gastritis, less commonly involve problems of common interest from a diagnostic point of view, since there are usually no roentgen findings characteristic of either condition. The diagnosis of these two types of gastritis depends chiefly on gastroscopic evidence. It is of interest in passing to point out that there is a close correlation between gastroscopic observations and the interpretation of the pathologist; however, there is not always close correlation between the (3) clinical symptoms and the gastroscopic findings in atrophic and superficial gastritis. There is at present much interest in gastritis, especially in atrophic gastritis, with regard to a possible relationship to gastric cancer.

The purpose of this paper is to discuss the clinical aspects of gastritis, particularly those features which are of common interest to the radiologist and the gastroenterologist. Cases will be presented to illustrate the more important clinical problems. In presenting the material an attempt will be made to elicit the problem rather than to formulate a statistical review. The cases have been selected from among a group of more than 2,400 patients who have been studied gastroscopically.

In this series the incidence of gastritis of various types approximates 20 per cent. The percentage in which this diagnosis has been clinically significant has been much lower. It is difficult, however, to arrive at any actual statistical evaluation of the clinically significant number, since the

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2-7, 1951.

Fig. 1. Case I. Roentgen picture indistinguishable from carcinoma or gastritis, due to adhesions secondary to gallbladder disease.

clinical importance varies greatly with associated conditions and with the physician who refers the patient. Some physicians overestimate and some underestimate the significance of the diagnosis of gastritis. Of particular interest has been the finding of 10 patients in this series with giant hypertrophic gastritis.

Since this paper is concerned with the clinical considerations of the subject, the material will be grouped in relation to the location of the lesion rather than to the type of gastritis.

ANTRAL LESIONS

Antral defects are often diagnosed as antral gastritis. Frequently, on x-ray examination, deformities are seen which may be due to disturbances in motor function, to a local lesion, or to edema associated with disease outside the antrum. In our experience the lesions of the antrum have been difficult to define. Localized antral gastritis does occur and gastric cancer is associated with antral gastritis in a high percentage of cases, as Hebbel has shown in a study of 199 carcinomas of the stomach (4). The specific differentiation of these antral lesions is occasionally clarified by the gastroscopist, but may call for surgical exploration in some instances.

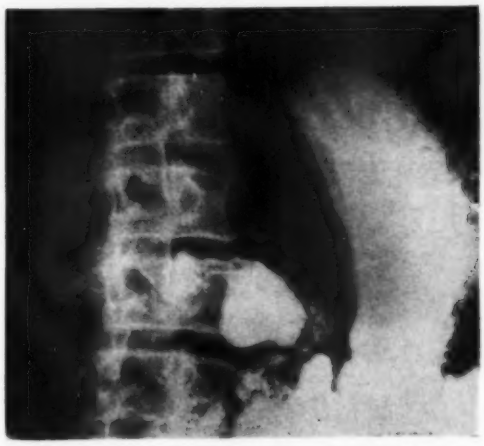

Fig. 2. Case II. Antral deformity indistinguishable from carcinoma, due to antral gastritis.

CASES

CASE I: A. B., male, age 48, gave a history of vague distress accompanied by some vomiting and a 15-pound weight loss in two months. Both roentgen and gastroscopic studies revealed a rigid antrum (Fig. 1) indistinguishable from carcinoma or gastritis. At surgery the deformity was found to be due to adhesions secondary to gallbladder disease.

CASE II: W. O., male, age 54, suffered considerable pain after meals and had a weight loss of 20 pounds in four months. An antral deformity was demonstrated by x-ray (Fig. 2), indistinguishable from carcinoma. Gastroscopy revealed a stiff antrum with edematous mucosa, and carcinoma could not be excluded. At surgery this lesion was

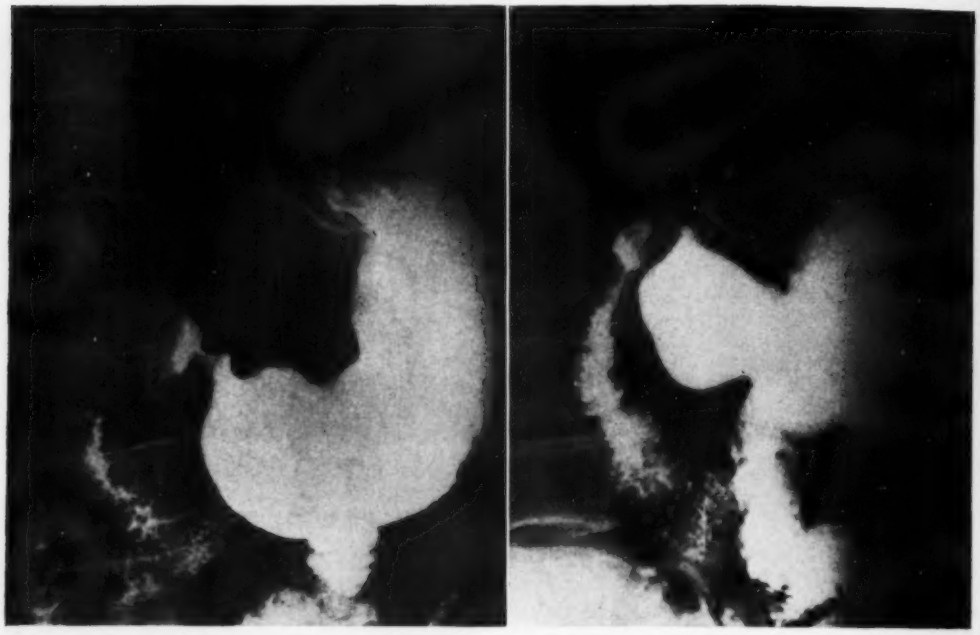

Fig. 3. Case III. Roentgenogram interpreted as normal in a patient with diffuse antral carcinoma.

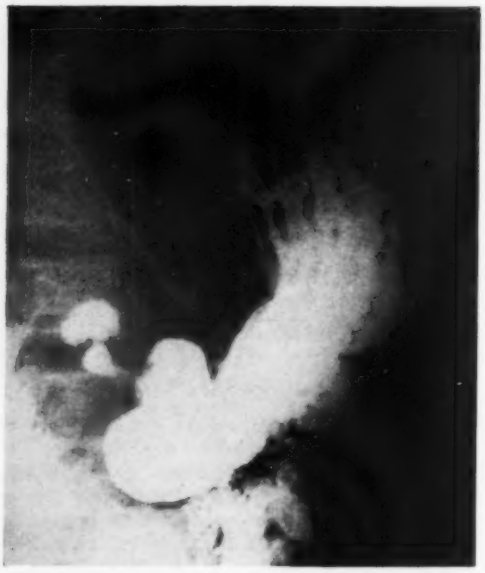

Fig. 4. Case IV. Persistent narrowing of the antrum in a patient found at operation to have normal gastric mucosa.

resected and proved to be a diffuse antral gastritis.

CASE III: W. B., male, age 73, had vague symptoms referable to the upper abdomen, with an associated secondary anemia. Roentgen findings (Fig. 3) were interpreted as being within normal limits, with spasm of the antrum. Gastroscopy revealed a diffuse carcinoma of the antrum, proved at surgery.

CASE IV: F. P., male, age 48, had some pain in the upper abdomen, nausea and vomiting, and no weight loss. X-ray examination (Fig. 4) revealed a persistent narrowing of the antrum. The gastroscopic appearance was normal. Surgery revealed a normal gastric mucosa.

In these confusing antral lesions the history will occasionally be an aid in the diagnosis or approach to therapy. Certainly such findings as frequent vomiting, marked weight loss, bleeding, and anemia add to the gravity of our clinical interpretation. The antrum can frequently confuse the gastroscopist and give an unwarranted feeling of security in some instances. For this reason it is felt that negative gastroscopic findings, or a gastroscopic diagnosis of antral gastritis, cannot be regarded as conclusive. Nor can the finding of antral gastritis on biopsy rule out the presence of a hidden antral carcinoma. In addition, the antral lesions, at least mechanically, are the most amen-

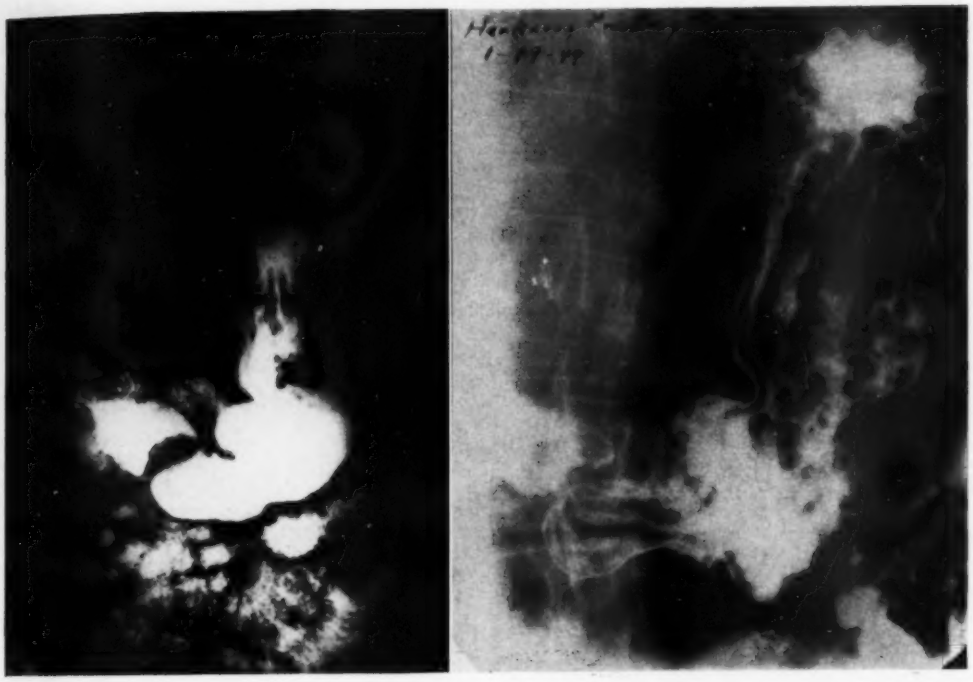

Fig. 5. Case V. Roentgenograms suggesting polyposis in a patient with low-grade carcinoma. See Fig. 6.

able to surgical therapy, and, when a benign antral lesion is removed, the patient has not been disabled so severely as in the removal of more diffuse lesions. For these reasons, it is often important to undertake surgical exploration in confusing antral lesions.

DIFFUSE LESIONS

In the diffuse lesions of the stomach the accuracy of diagnosis is of greatest importance. Here the diagnostic impression determines the approach to therapy, involving frequently the performance of a total gastrectomy. If we are to offer the patient with a diffuse carcinoma a chance for a cure, the treatment is surgical. On the other hand, a total gastrectomy is radical therapy for a benign lesion. Some surgeons feel that benign lesions of the stomach are precursors of malignant growth and should be removed. In many instances various clinical features may be important and decisions should be made on the basis of an honest evaluation of all the findings at our disposal. The following cases present various features of clinical interest.

Fig. 6. Case V. Autopsy specimen showing low-grade carcinoma.

CASES

CASE V: M. H., female, age 70, gave a vague history of years of indigestion. She had severe arteriosclerotic heart disease with potential decompensation. X-ray examination (Fig. 5) and gastroscopic impressions indicated polyposis, with no definite

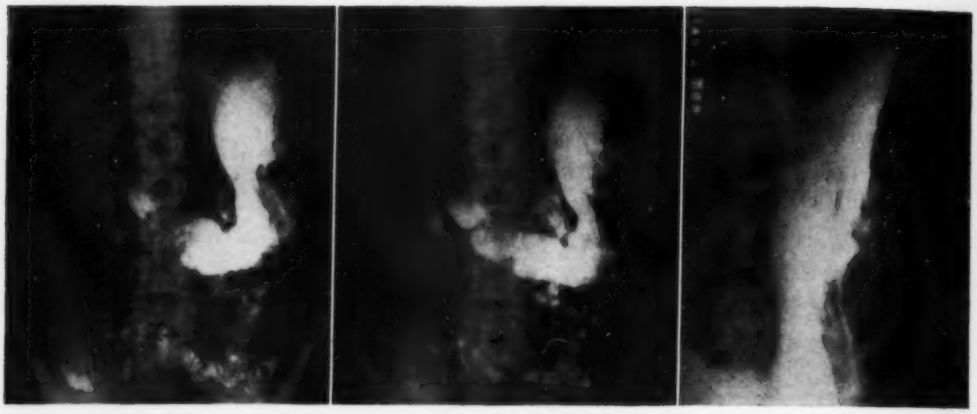

Fig. 7. Case VI. Localized tumor formation due to hypertrophic gastritis, interpreted as probable cancer. See Fig. 8.

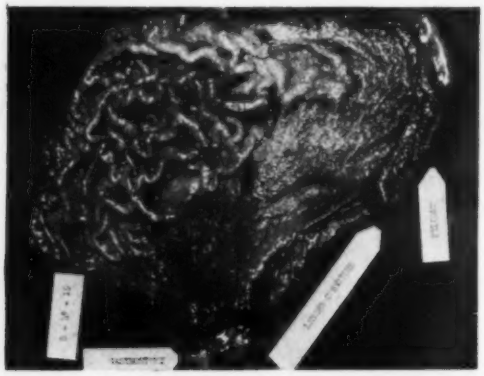

Fig. 8. Case VI. Operative specimen showing hypertrophic gastritis.

evidence of a malignant growth. Surgery was not recommended, the only surgical indication being low-grade or potential malignancy. A young individual in good health probably would have been advised to have a resection. A conservative course was adopted and six months later the patient died of cardiac disease. Autopsy showed the gastric lesion (Fig. 6) to be a low-grade carcinoma.

In this instance the diagnosis was not exact, but the proper clinical decision was made. There was no gastritis, but these lesions frequently imitate gastritis.

CASE VI: O. A., female, age 70, complained of weakness, dyspepsia, intermittent vomiting, and a 10-pound weight loss. Physical and laboratory findings were not contributory. X-ray examination (Fig. 7) revealed localized tumor formation interpreted as probable cancer. At gastroscopy, localized hypertrophied mucosal folds of the greater curvature with surrounding atrophy were seen. A subtotal gastric resection was performed, and the specimen (Fig. 8) showed localized hypertrophic gastritis. This case presented hypertrophied rugae which were suspicious of tumor formation radiologically, but looked innocent gastroscopically. At surgery a resection was performed because of the question of malignancy and the definitely localized gross enlargement of the gastric folds. This patient has done well postoperatively and surgery has apparently been helpful symptomatically. If this lesion is a precursor of cancer, the malignant potential has been removed.

CASE VII: A. B., male, age 45, gave a history of long-standing dyspepsia, recent weight loss of 15 pounds, and bleeding from large hemorrhoids. Physical findings were not contributory. Gastric analysis revealed histamine achlorhydria. X-ray examination (Fig. 9) demonstrated large stiff mucosal folds, some suggesting tumor formation. Gastroscopic examination revealed unusually large folds with some stiffness of the mucosa and a velvety appearance but no necrosis or ulceration.

This patient presents the critical problem of diffuse involvement of the whole stomach. The x-ray examination was not conclusive but was suspicious of a malignant process, while the gastroscopic examination was suggestive of a benign hypertrophy of the mucosa. At operation, the surgeon felt that a malignant tumor could not be excluded, and performed a total gastrectomy. The gross specimen (Fig. 10) showed marked enlargement of the gastric rugae. The microscopic examination was reported as gastritis polyposis (giant hypertrophic gastritis). The patient died about six weeks after total gastrectomy.

CASE VIII: I. W., female, age 48, had vague upper abdominal distress for years, with recent weight loss. There were no significant physical or labora-

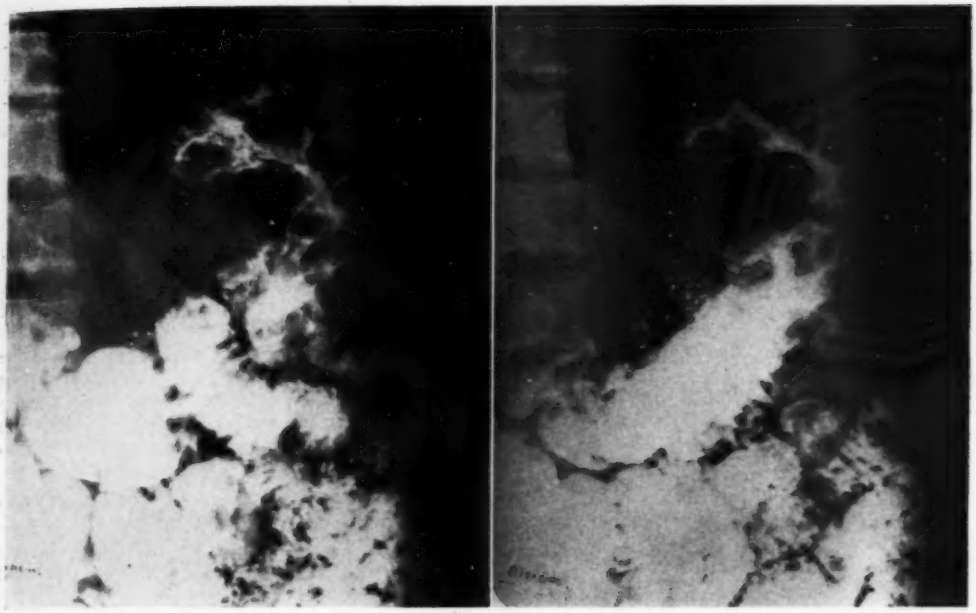

Fig. 9. Case VII. Large stiff mucosal folds, some of which suggested tumor formation. See Fig. 10.

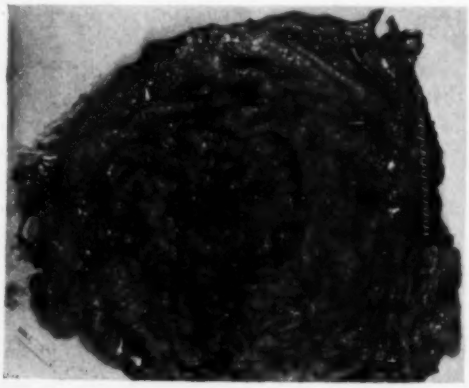

Fig. 10. Case VII. Operative specimen showing greatly enlarged gastric rugae. Microscopic diagnosis: giant hypertrophic gastritis.

tory findings. X-ray examination (Fig. 11) revealed tremendous enlargement of the mucosal folds and stiffness of the mucosa along the greater curvature, which together with a piling up of the mucosa in this area suggested tumor formation. At gastroscopy the diagnosis was giant hypertrophic gastritis. At operation the lesion appeared to be benign and the surgeon did a biopsy of the most suspicious lesion near the greater curvature. On frozen section, and later on fixed section, this showed no evidence of malignancy and resection was not performed. The patient has had a persistent dyspepsia but has maintained a reasonable degree of good health for four years.

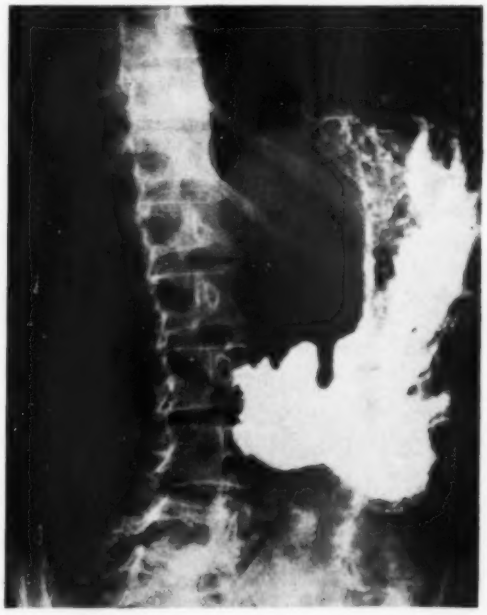

Fig. 11. Case VIII. Great enlargement of mucosal folds suggesting tumor formation. No evidence of a malignant process on operation.

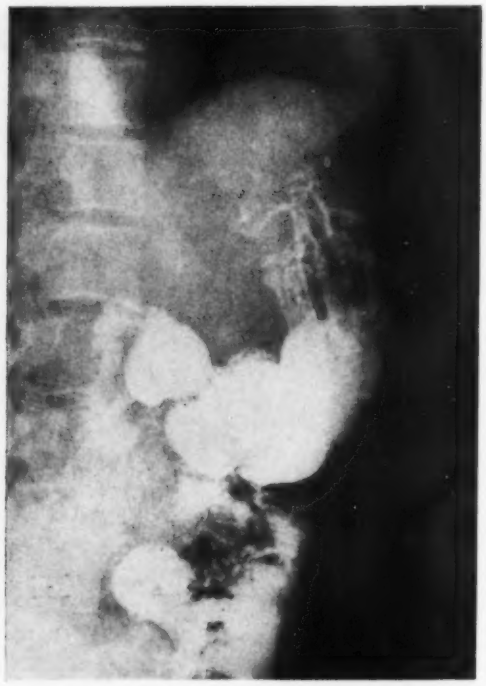

Fig. 12. Case IX. Enlarged mucosal fold in the cardiac area. On exploration the gastric mucosa was normal.

The diffuse gastric lesions present a critical problem. The decision as to therapy must be made on the basis of possible malignancy. To the present, there is no justification for a total gastrectomy in benign lesions, and yet this is the only procedure which gives any hope to the patient with carcinoma. For this reason, we should attempt to utilize all facilities available for distinguishing these lesions. Gastroscopic biopsy methods will probably offer the best answer in the future.

LESIONS OF THE CARDIA

Localized gastritis producing a defect demonstrable by x-ray in the cardia is rare. However, occasional lesions in this area do lend themselves to consideration from the standpoint of differential diagnosis. Sometimes the gastroscopist may be of assistance. Negative findings, however, are not of significance and cannot, at any time, take precedence over positive findings from the roentgen standpoint. A diagnosis of localized hypertrophic gastritis in the cardia should be looked upon with suspicion. In our experience enlarged mucosal folds at this site have been due to neoplasm or hyperplasia of the folds.

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CASE IX: M. K., female, age 45, was admitted complaining of epigastric distress of a vague nature. Physical and laboratory findings were not conclusive. X-ray examination (Fig. 12) revealed an unusual mucosal pattern, which the radiologist felt was due to enlarged normal mucosal folds, but tumor was suspected by the clinician. Gastroscopic findings revealed normal appearing folds in the cardia. The patient was explored surgically and was found to have normal appearing gastric mucosa.

CASE X: R. C., age 78, presented a long history of pernicious anemia. He had shown a good reticulocyte response to liver therapy but severe anemia persisted and tests for blood in the stool were positive. The x-ray examination (Fig. 13) was interpreted as showing enlarged mucosal folds. At gastroscopy, a large lesion was found which was considered to be a carcinoma. This diagnosis was proved (Fig. 14) at surgery and a total gastrectomy was performed.

In general, the lesions in the cardia are difficult to evaluate gastroscopically, and, in many instances, the roentgen interpretation is also inconclusive. In our experience, lesions in this region are seldom due to localized gastritis. Positive findings by either diagnostic method must be considered significant.

DISCUSSION

In general, gastritis is diagnosed by gastroscopy. Superficial and atrophic gastritis give no characteristic roentgen or clinical signs. Hypertrophic gastritis produces characteristic changes only when the rugae are markedly hypertrophied. The mucosal changes seen gastroscopically are seldom of such magnitude as to produce changes on the roentgenogram. When large folds of an unusual nature are demonstrated by x-ray, a definite diagnosis is frequently difficult to obtain. The combined facilities of roentgenology, gastroscopy, biopsy, clinical evaluation, and cytology often are necessary in making

the final decision as to therapy. On some occasions, surgical exploration is required to arrive at a diagnosis. A decision in favor of surgery must depend on a variety of factors. Total gastrectomy for diffuse gastric lesions should be considered only in instances where there is reasonable proof of the existence of a malignant lesion.

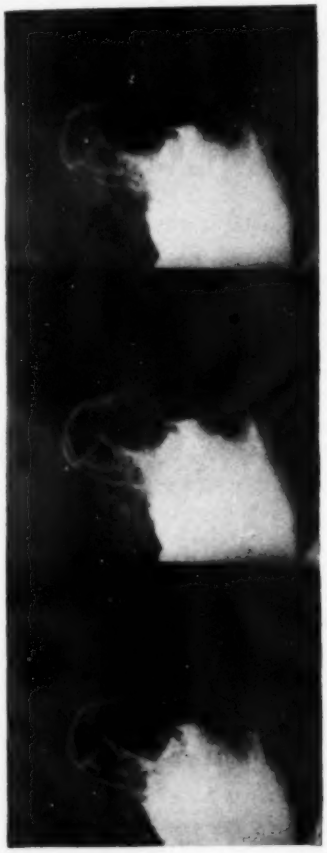

Fig. 13. Case X. Enlarged mucosal folds at the cardia in a case of carcinoma.

Proof of gastritis as a precursor of carcinoma is not sufficiently documented to warrant a total gastrectomy.

CONCLUSIONS

1. Antral lesions are difficult to define gastroscopically in many instances. The roentgen method may demonstrate antral disease not visible with the gastroscope.

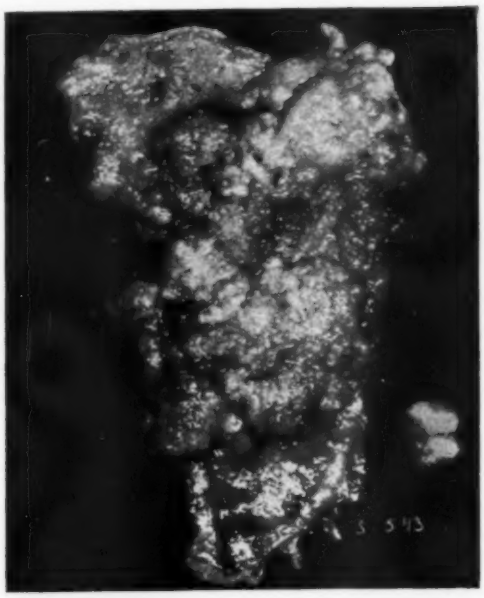

Fig. 14. Case X. Operative specimen showing carcinoma.

2. Diffuse enlargement of gastric folds presents an important diagnostic problem in which the proper utilization of all procedures must be employed to secure the correct diagnosis.

3. Lesions of the cardia producing a roentgen defect are seldom due to localized gastritis.

4. Cases have been presented to illustrate the types of lesions and some of the clinical features related to the gastritides which produce changes visible to the roentgenologist.

5. Clinical judgment dictates the therapeutic approach to some gastric lesions in spite of important scientific and technical observations.

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SUMARIO

Los Aspectos Clínicos de la Gastritis y los Hallazgos Gastroscópicos

La gastritis se clasifica más sencillamente en superficial, atrófica e hipertrófica. La superficial y la atrófica no suelen presentar hallazgos roentgenológicos significativos. Este trabajo versa, por lo tanto, principalmente sobre la gastritis hipertrófica, la cual produce típicas alteraciones roentgenológicas únicamente cuando las arrugas están sumamente hipertrofiadas.

Las lesiones antrales confunden tanto al radiólogo cuanto al gastroscopista. Acaso ni la biopsia revele un carcinoma oculto, y puede necesitarse una exploración quirúrgica para el diagnóstico.

Las lesiones difusas del estómago plantean un problema peliagudo, dado que la decisión en cuanto a terapéutica reposa en un diagnóstico de benignidad o malignidad.

La gastritis localizada en el cardias es rara, y la hipertrofia de los pliegues de la mucosa en dicha región suele ser imputable a neoplasia o hiperplasia simple.

Preséntanse casos que muestran las formas de lesión encontradas y algunas de las características clínicas y gastroscópicas de la gastritis. El juicio clínico dicta en algunos casos el ataque terapéutico, independientemente de las observaciones más técnicas.

Difficulties in the Differential Diagnosis of Gastric Carcinoma and Gastritis[1]

Surgical Considerations

THOMAS J. KENNEDY, M.D.

Denver, Colo.

MY CONTRIBUTION to this symposium will appear to some pessimistic and negativistic. My thesis is brief. I say that the radiologist, yes, and even the gastroscopist as he popularly uses his instrument today, are unable to differentiate with sufficient accuracy between certain cases of gastritis and gastric neoplasms to warrant withholding surgical biopsy (excision) from patients with stomach disease falling into this differential classification.

After critical analysis, many among us have found it impossible by study of the gross morphology of some gastric lesions (by either roentgen or gastroscopic methods, or even when handling and viewing the surgically removed specimen) to differentiate certain inflammatory diseases of the stomach from infiltrating types of cancer.

Not being eminently qualified as an authority on this problem, I must draw upon the literature and statements of those men recognized in radiology and gastroscopy to reinforce my categorical assertion. B. R. Kirklin (23, 17) has said that there are cases in which he finds it impossible to distinguish between gastritis and carcinoma. H. W. Schmidt (22) has informed me that, in spite of what is being written in the literature today about the value of gastroscopy, it is often impossible for a gastroscopist to make a differentiation between severe gastritis and carcinoma until such a time as he can safely obtain tissue from the stomach. Moersch (1) reported an error of about 10 per cent in the gastroscopic differential diagnosis between certain types of gastritis and gastric cancer. Likewise, Moersch and Kirklin (2) found an experienced roentgenologist about 10 per cent in error when distinguishing certain gastric neoplasms from gastritis. In 6 to 10 per cent of later proved cases of gastritis and carcinoma, even the surgeon at exploration could not tell whether the gastric disease was benign or malignant, the final diagnosis depending upon microscopic study of excised tissue. Palmer *et al.* (3), presenting 6 cases of giant hypertrophic gastritis subjected to surgery, say that from the point of view of clinical diagnosis differentiation from carcinoma was not satisfactory either by gastroscopy or roentgenology. They also note that, although areas of mucosal polypoid hypertrophy are not common in diffuse giant hypertrophic gastritis, the gross separation of the latter from polypoid adenomata is difficult or impossible. And since some 20 per cent of gastric polyadenomata *en nappe* will have malignant changes in one or several of the polyps (3), a diagnosis of either would merit gastric resection. Many authors, as Vaughan (4), Arendt (5), Harris (6), Bank *et al.* (7), Rennie (8), Lyall and Leider (10), report one or more cases showing certain types of gastritis to be indistinguishable clinically from carcinoma. Their conclusions can be collectively summarized as follows: Certain types of gastritis are indistinguishable from cancer even at exploration, and, occasionally, even by frozen-section study, the latter depending largely upon the experience of the consultant pathologist; gastric resection is indicated not only to make a positive diagnosis, but also to effect a cure. Swalm and Morrison (9), after following by periodic gastroscopy a large group of cases of gastritis receiving various forms of

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

treatment, conclude that neither the hypertrophic nor atrophic form is amenable to any known conservative measures.

There exists today much diversity of opinion regarding the clinical and precancerous potentials of gastritis. Spriggs and Marxer (12) observed 19 cases of polypoid hypertrophic gastritis over periods of one to fourteen years and in none did malignant changes develop. They say that relief can be obtained with a strict dietary regime, control of the mode of life, and correction of existing sepsis. Hebbel (18) found no evidence, in a series of 52 resected carcinoma-bearing stomachs, to indicate that cancer arises with unusual frequency in stomachs already the seat of a diffuse atrophic gastritis. Ehrich (20) quotes Stewart as saying that after the age of forty atrophic gastritis is almost as common in patients without cancer as with cancer. Stewart believes there is no evidence that atrophic gastritis is a precancerous condition.

On the other hand, Abrahamson and Hinton (11) believe that in the vast majority of cases gastric cancer arises from mucosa which is the seat of long-standing chronic gastritis. Palmer *et al.* (16, 19), although finding no clear relationship of gastritis to carcinoma, believe atrophic gastritis predisposes to cancer, especially the atrophic gastritis of pernicious anemia. Yet they have gastroscopically observed, for periods up to eleven years, various types of gastritis in 14 patients without detectable serious consequences.

It has been a little over three years since Benedict (28), who originally introduced gastroscopy in this country (29), made the first successful biopsy of the stomach with the flexible operating gastroscope. He claims (24) that a satisfactory biopsy from the proper location with the use of this instrument definitely settles the question of gastritis, lymphoma, and diffuse carcinoma. He admits, however, that it is not easy to obtain a biopsy from the antrum, and I raise the question, also, of the usefulness of the operating gastroscope in those rare cases of gastritis and linitis plastica where the mucosa is relatively normal and the histopathological changes are found in the submucosa and muscularis. It is reasonable to assume, however, that in the future no gastroscopic examination will be complete unless biopsy under direct vision is available (25–27).

There is still justifiable pessimism regarding cure of gastric cancer. Yet it is recognized that early expert resection will increase the survival rate. Today in the United States there are more deaths from cancer of the stomach than from all malignant lesions of the lip, tongue, cheek, tonsil, pharynx, larynx, salivary glands, thyroid, male and female breast, ovary, uterine cervix and corpus combined (15). Wangensteen (13) finds only 25 per cent of all gastric cancer patients candidates for resection of a curative nature. He quotes Walters, Gray and Priestley (14) as showing only 6 per cent five-year survival for all cases of gastric cancer, though of those who survive curative resection 28.9 per cent live five years and 20.4 per cent ten years.

Walters *et al.* (30), reporting recently on results of gastric surgery at the Mayo Clinic for 1949, showed a hospital mortality of 5.4 per cent for partial gastrectomies in 148 cases of malignant growth. For 20 total gastrectomies the hospital mortality was 15 per cent. For 159 cases of benign gastric ulcer partially resected, the mortality was 1.9 per cent and in 18 partial resections for gastritis there was no mortality.

Thus, with an operative mortality of 0 to 5.4 per cent for partial gastrectomies, in electing to treat conservatively a lesion of the stomach regarding the malignancy or benignancy of which experienced gastroscopists and radiologists can find themselves each about 10 per cent in error, the clinician assumes a responsibility which, percentage-wise, is unfair to the patient and his chance of survival.

Should partial gastrectomy be possible for a lesion which may be either benign or malignant, an attempt should be made to include a cuff of grossly normal tissue

of 4 to 5 cm. width on both sides of the lesion, with an immediate check by expert frozen-section study to determine whether or not malignancy exists. If malignant tissue is found, then both ends of the resected specimen should be immediately studied to determine whether there are malignant cells at the site of resection (30). Regarding the accuracy of expert frozen-section technic, Dockerty (21) has told me that in the past five years he has not had a single case in which fixed sections of an antral carcinoma showed malignancy which had been missed by the fresh polychrome frozen technic. He also mentioned, parenthetically, that some of the lesions seen are undiagnosable grossly.

My conclusions are summarized thus: Early diagnosis of gastric cancer holds a key to improved prognosis. Several authorities, both radiological and gastroscopic, clearly show that it is often impossible to make a clinical diagnosis between a benign and malignant gastric process. Some writers postulate gastritis as a probable precursor of carcinoma of the stomach, and some point out that resection is the only curative treatment of gastritis. It is therefore of questionable practical value (although of academic interest, I will agree) to argue the problem of exact differentiation between certain types of gastritis and gastric carcinoma. It is my belief that a diagnosis of either condition calls for careful consideration of expert excision of the involved portion of the stomach accompanied by immediate expert frozen-section study of the specimen. If malignant tissue be found, an immediate frozen-section study of the edges of the resected specimen should be carried out to determine whether the resection has been radical enough. This should, of course, be followed by adequate excision of the stomach lymph drainage areas. Recently, Lahey (31) has been advocating total gastrectomy for early and intermediate gastric cancers in order that more complete removal of lymph drainage areas can be accomplished, and there may be merit in his advocation.

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SUMARIO

Dificultadas Planteadas por el Diagnóstico Diferencial del Carcinoma Gástrico y la Gastritis. Consideraciones Quirúrgicas

En el diagnóstico temprano del cáncer gástrico se cifran las esperanzas de mejorar el pronóstico. Varias autoridades reconocidas, tanto radiológicas cuanto gastroscópicas, han demostrado claramente que es imposible a menudo hacer la diferenciación clínica entre un proceso gástrico benigno y uno maligno. Presuponen algunos autores que la gastritis es un probable precursor del carcinoma del estómago, señalando algunos que la resección es el único tratamiento curativo de la gastritis. Por consiguiente, resulta de valor práctico dudoso (aunque de interés teórico) argüir acerca de la diferenciación exacta entre ciertas formas de gastritis y el carcinoma gástrico. Opina el A. que el diagnóstico de uno u otro estado exige cuidadosa consideración de la posible excisión experta de la porción afectada del estómago, acompañada de inmediato estudio de cortes congelados del ejemplar. Si se encuentra tejido maligno, se llevará cabo un estudio en corte congelado de los bordes del ejemplar resecado para determinar si la resección fue suficientemente radical. Esto irá seguido de la excisión adecuada de las zonas gástricas de riego linfático.

Pathology of Gastritis[1]

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GASTRITIS may be defined as an inflammation of the stomach. The present tendency is to limit the use of the term to those inflammatory conditions which are usually chronic in nature and are characterized by a cellular infiltration and by degenerative or regenerative changes in the surface epithelium, the glands, and the crypts. The purpose of this paper is to present the gross and microscopic features of chronic gastritis. A simple classification of the disease will be followed which, the authors believe, satisfies the needs of the clinician as well as of the pathologist.

A review of the literature on the pathology of gastritis reveals the difficulties which faced the early observers. Stomach specimens were rarely obtained for study before postmortem changes had taken place. Injection of the stomach with a tissue fixative as soon as possible after death eliminated much of this difficulty. With the advent of gastrectomy as a surgical procedure, the pathologist was provided with a specimen which represented more nearly the true condition of the gastric mucosa. However, observers have noted that a segment of stomach removed by surgery must be subjected to tissue fixation at once to prevent autolysis. Furthermore, the trauma incident to surgical removal may cause changes in the histologic appearance as a result of distortion, crushing, hemorrhage, etc. Benedict and Mallory, and Gitlitz and Colp are in agreement that resected specimens are satisfactory for histologic study, provided surgical care is exercised and the tissue is fixed promptly. Biopsy specimens obtained through the gastroscope yield satisfactory material, provided the specimen is of sufficient size, is from a representative area, and is not traumatized during removal.

In spite of the fact that pathologists of today have relatively good material available for study, they are not in complete agreement concerning the criteria on which a diagnosis of chronic gastritis may be made. This is due to a lack of uniformity of opinion as to: (1) the degree of atrophy or hypertrophy of the gastric mucosa, and (2) the amount and distribution of cellular infiltrate in the mucosa which can be considered abnormal. For these reasons, a brief review of the gastric mucosa seems justified.

The normal gastric mucosa has a mammillated appearance (*areae gastricae*) produced by longitudinal folds and by raised areas varying from 1 to 5 mm. in diameter. The gastric pits contribute to the irregularity of the mucosal surface. The gastric glands are of three types—cardiac, body, and pyloric. The cardiac glands are mucoid compound-tubular glands which extend from the proximal end of the stomach for a distance of 3 to 4 cm. Here, they merge rather abruptly into the body glands, which extend to the so-called "histological antrum," where the pyloric glands are located. The body glands, also known as the fundic and chief glands, produce acid and pepsin. They are simple tubular glands which are closely packed. The body mucosa averages about 1 mm. in thickness. The crypts extend into the glands for a distance of 25 to 30 per cent of their depth. The mucoid branched-tubular pyloric glands are found in the distal end of the stomach. The thickness of the mucosa in this area is similar (1 mm.) to that in the body or fundus. The crypts, however, are deeper, occupying 50 to 60 per cent of the gland depth.

[1] From the Department of Pathology, Quain and Ramstad Clinic, Bismarck, N. Dak. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

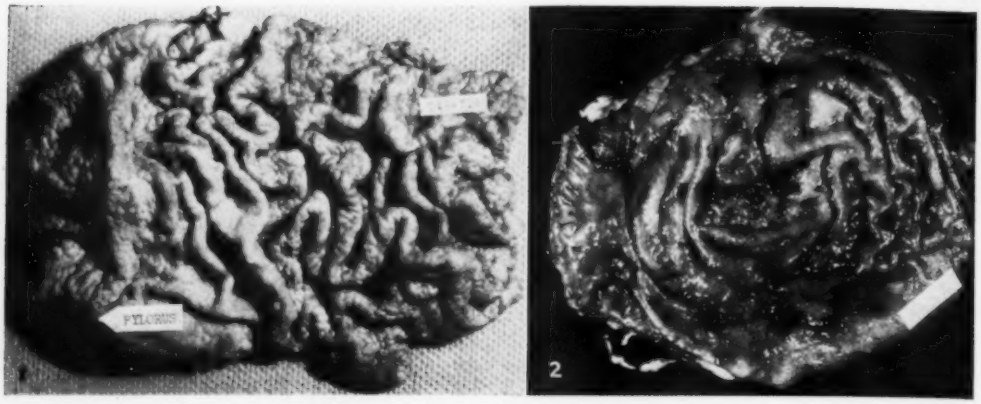

Fig. 1. Chronic hypertrophic gastritis. Note giant rugae.
Fig. 2. Atrophic gastritis. The mucosa is smooth and glistening.

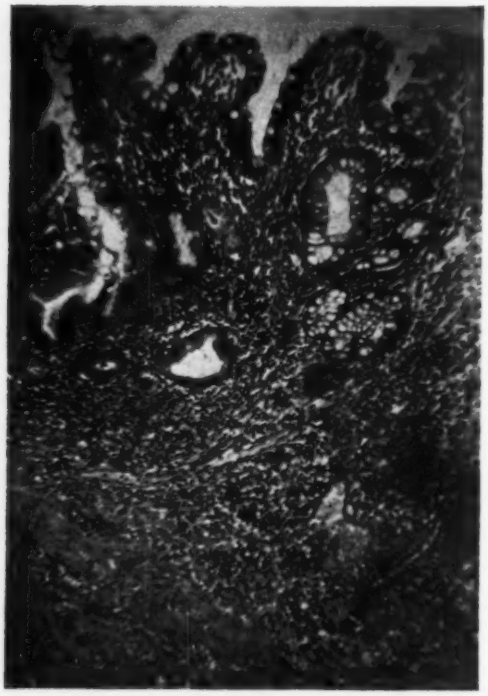

Fig. 3. Atrophic gastritis. Note the intestinal type epithelium superficially. Numerous goblet cells are present. ×70

The pyloric glands extend higher on the lesser curvature than on the greater curvature. The antrum, which they occupy, consists of a roughly triangular area in the distal stomach, in which the apex is located on the lesser curvature, at a point called the angulus, and the base is at the pylorus.

There is little agreement among observers as to the amount of lymphocytic infiltration of the gastric mucosa which can be considered normal. Early observers concluded that the normal mucosa contains few or no lymphocytes. Their observations, however, were based on studies in children. Later work has shown that in about 50 per cent of adults past middle life with no gastric symptoms the mucosa contains a moderate number to many lymphocytes. The number of lymph follicles present in the normal stomach is also debatable. Most observers agree that they are rare in infants. Some insist they are rare at any age in the normal stomach, while others are inclined to agree that a few lymph follicles, especially in the antrum and along the lesser curvature, can be considered normal, provided they are not accompanied by excessive lymphocytic infiltration of the mucosa. A few eosinophils in the mucosa are undoubtedly normal.

Unfortunately, the gross appearance of chronic gastritis is not always characteristic. Indeed, the diagnosis may depend entirely on the microscopic appearance of the mucosa, for it is not at all unusual to find no abnormalities in the gross pattern. The mucosal surface may be covered with mucus which is adherent

and tenacious. This material may be purulent. Little reliance can be placed on the color of the mucosa or on the presence of hemorrhage. The mucosa may exhibit thick folds in which the rugae stand out as large elevations separated by deep clefts. This is one manifestation of the so-called "hypertrophic form" of gastritis (Fig. 1). Occasionally, foci which are raised, irregular, and umbilicated are seen. The other extreme, in which the mucosa is pale and obviously thinned and smooth, is the atrophic variety (Fig. 2). Superficial erosions of the mucosa are an important gross finding, if evidence

Fig. 4. Chronic gastritis. Note cyst-like structure. ×33

of cellular infiltration can be demonstrated on microscopic examination.

The mucosal glands may exhibit hypertrophy or atrophy. In the hypertrophic form they are larger than normal. In the atrophic form they are diminished in size, at times to the point where they are completely absent, in which case the

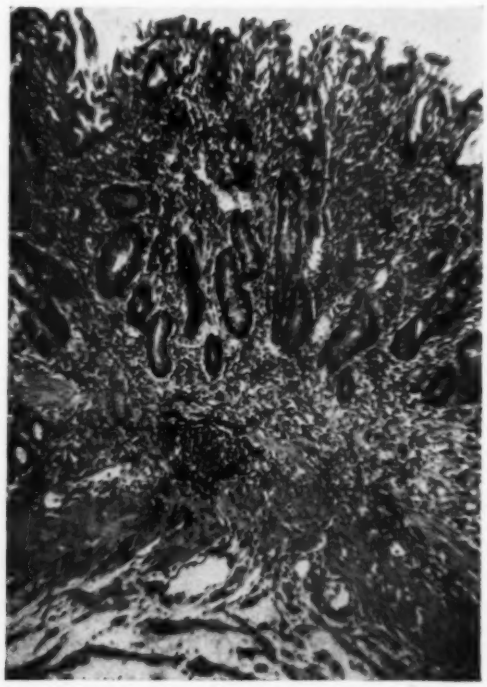

Fig. 5. Atrophic gastritis. The muscularis mucosae is considerably thickened and infiltrated with fibrous tissue. ×65

mucosa is reduced to a thin membrane covered with surface epithelium. The presence of the intestinal type of epithelium and glands in the gastric mucosa is considered indicative of gastritis (Fig. 3). Arey and Bothe ascribe this phenomenon to heteroplasia of gastric glands destroyed by inflammation. Furthermore, they state that this change is reversible, the cells and glands of intestinal type reverting to normal when normal conditions are restored to the mucosa. Persistent groups of glands may remain as adenoma-like or as cystic structures (Fig. 4). The muscularis mucosae, and occasionally the submucosa, may be infiltrated with fibrous tissue (Fig. 5). The latter is of importance because, as has been demonstrated by Forssell, the tone of the muscularis mucosae determines the size and character of the gastric rugae as visualized by the radiologist.

The degree of cellular infiltration in the

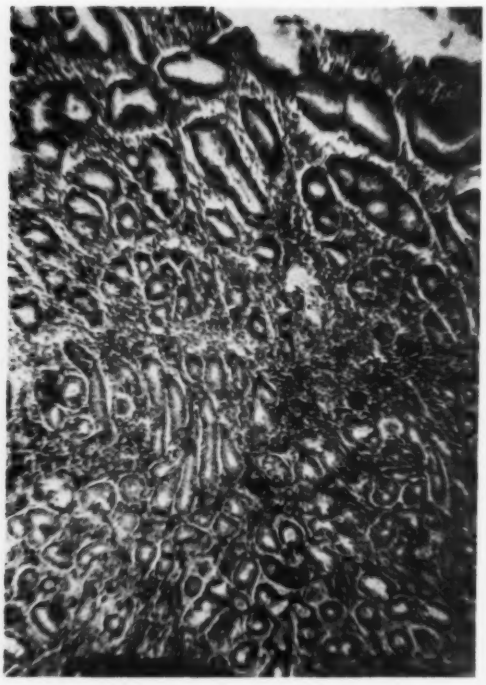

Fig. 6. Chronic hypertrophic gastritis. Note the thickened mucosa due to glandular hypertrophy and hyperplasia. ×65

mucosal stroma, although difficult to evaluate because there is no positive dividing line between the normal and the abnormal, is of great importance. The literature contains statements that the mucosa shows "lymphocytic infiltration," "heavy lymphocytic infiltration and plasma-cell infiltration," and "marked lymphocytic infiltration." No wonder the pathologist encounters difficulty in evaluating the extent of infiltration in a given specimen. Benedict and Mallory proposed a classification of mucosal infiltration which merits consideration, although, if strictly adhered to, it will decrease the frequency with which a diagnosis of gastritis is made by the pathologist. They set forth four grades of involvement. A Grade I infiltration shows scattered small foci of plasma cells and lymphocytes. Grade II takes the form of a narrow, continuous band, localized sharply about the neck zone of the glands. In Grade III the band is wider, occupying from one-third to one-half the mucosa. Grade IV extends from the above to a complete infiltration of the mucosa. In a control series of 50 stomachs removed at autopsy and fixed with particular care, these workers found no stomach without some infiltration of at least the

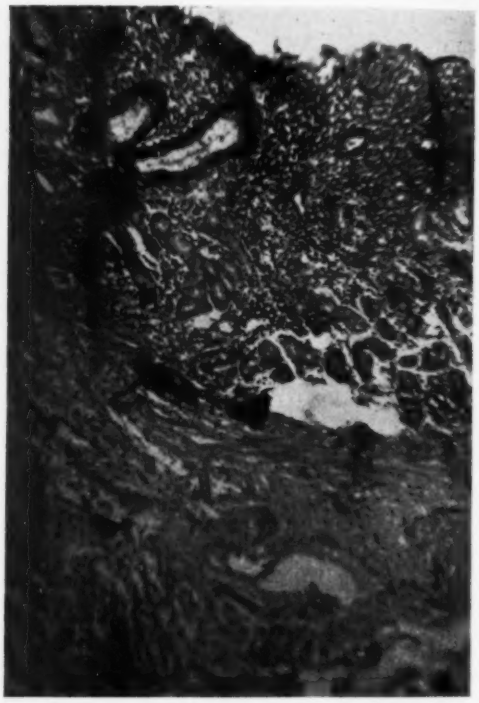

Fig. 7. Chronic atrophic gastritis. The mucosa is thinned and the glands are widely spaced. The entire mucosa is diffusely infiltrated with chronic inflammatory infiltrate. ×65

antral portion. They concluded, furthermore, that Grades I and II are so frequent that they must be considered as within normal limits; also that infiltration of the fundus must be of Grade III and infiltration of the antrum of Grade IV to be considered definitely pathological. Their observations lend support to the view held by many observers that the changes in the gastric mucosa, which are often identified as gastritis, are merely manifestations of normal processes. They do not, however, exclude the existence of gastritis as an entity. On the contrary, they pro-

vide the pathologist with a valuable means of determining when such an entity actually exists.

Except for the difference in the size and number of the glands, the microscopic features of chronic gastritis are fundamentally the same whether the mucosal folds are larger or smaller than normal. The essential features are infiltration with inflammatory cells and alterations of the epithelial tissue (Fig. 6 and 7). An exudative reaction may occur, however, which presents different histologic findings from those described above. Here, polymorphonuclears appear in large numbers, particularly in the upper mucosa. There is a concomitant diminution in the mucous vacuolization, which may extend well down into the glands. Russell's bodies are increased. This exudative reaction may be superimposed on any of the above described types of reaction.

Numerous attempts have been made to correlate the gastroscopic, radiologic, and pathologic findings in gastritis. To date, they have not been entirely successful. Some writers contend that a diagnosis of "gastritis" is sufficient, qualified according to the predominant change present, by such adjectives as "hypertrophic," "atrophic," "cystic," "polypoid," "ulcerative," or "follicular." Others would utilize the degree of acidity present as the determining factor, but this obviously gives no indication of the histopathology. Inasmuch as there is a common denominator for all the pathologic changes in gastritis, it would seem that the old classification of chronic hypertrophic and chronic atrophic would offer the simplest and the most direct approach to the problem. In addition to the hypertrophic and atrophic forms, a third type, superficial gastritis, should be added, since it is a form often observed by gastroscopists. Its histopathologic features are identical with those of the exudative reaction referred to above.

To summarize, the manner in which a given case of gastritis is to be classified will depend upon whether hypertrophic, atrophic, or exudative changes predominate. It should be emphasized that mixed types of gastritis are not uncommon and the three types may be present in any combination simultaneously.

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(*Para el sumario en español, véase la página siguiente.*)

SUMARIO

Anatomía Patológica de la Gastritis

El aspecto macropatológico de la gastritis crónica no es siempre típico. En la forma hipertrófica, la mucosa puede manifestar pliegues espesos de los que proyectan las arrugas a modo de grandes elevaciones separadas por hondas hendiduras. En la forma atrófica, la mucosa aparece pálida y evidentemente adelgazada y lisa. Las erosiones superficiales de la mucosa constituyen un importante hallazgo macroscópico, si el examen microscópico puede descubrir signos de infiltración celular.

Las glándulas mucíparas pueden revelar hipertrofia o atrofia. La presencia de epitelio y glándulas de tipo intestinal en la mucosa gástrica pasa por ser indicación de gastritis. La mucosa muscular, y a veces la submucosa, pueden estar infiltradas por tejido fibroso.

La intensidad de la infiltración celular en el estroma mucoso reviste mucha importancia, aunque es difícil valorarla.

Las esenciales características microscópicas son la infiltración por células inflamatorias y las alteraciones del tejido epitelial. Puede sobreponerse una reacción exudativa a las demás modificaciones.

La clasificación de un caso dado se basará en el predominio de alteraciones hipertróficas, atróficas o exudativas.

Problem of Pathogenesis of Chronic Hypertrophic Gastritis[1]

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INFLAMMATIONS of the stomach may be divided roughly into acute and chronic. Among the chronic cases, some are specific in nature, as tuberculosis and parasitic infestations; these are rare, leaving a majority which are of obscure origin. A further division may be made on a basis of tendency toward hypertrophy or atrophy. Hypertrophy is found more often than atrophy in chronic gastritis; this report is concerned chiefly with the hypertrophic form.

Knowledge concerning the pathogenesis of chronic hypertrophic gastritis is seriously incomplete. The solution of the problem will require well integrated study by a team composed of internist, gastroscopist, surgeon, radiologist, and pathologist. The study should be carefully planned in advance, rigidly controlled, and carried out over an extended period of time, with both observational and experimental technics.

Chronic hypertrophic gastritis may be a type of reaction to a number of different pathogenetic forces. Among the possible etiologic factors that have been suggested are the ingestion of stimulating or irritating substances (1, 4), such as alcohol and condiments. The ingestion of alcohol, however, rather than being an actual cause of gastritis, may be only a manifestation of an underlying nervous constitution of a type leading to the production of gastric disorders. Mucosal irritation by alcohol could, of course, act as a source of injury added to, or superimposed upon, injury from a neurogenic factor (the latter to be discussed later).

The ingestion of bacteria or their toxins may be mentioned (1). This ordinarily would be associated with food poisoning or gastritis (and enteritis) of a more acute type, usually occurring on isolated occasions, and not often repeated, whereas it is probable that in most cases chronic hypertrophic gastritis is a result of repeated injury, whatever its nature may be. Further, except in the presence of a relatively high pH, any pathogenic bacteria are killed fairly rapidly by gastric juice, and the organisms or their toxins would need to be present in large concentrations in order to exert a noteworthy effect. Some organisms, notably streptococci, might conceivably introduce a factor of allergic tissue injury, as in rheumatic processes. The same could be true of organisms or toxins gaining entry through the blood stream. Necrosis, with attendant inflammatory, epithelioid, and fibroblastic reaction, of characteristically rheumatic type, is not seen in chronic hypertrophic gastritis. Experimental introduction of antigen composed of a combination of streptococci with extract of gastric wall could be carried out, with the expectation that antibody produced in response to the injected antigen might conceivably injure the gastric tissue of the experimental animal. Localization of any lesions resulting from such a procedure to the stomach and upper duodenum, to the exclusion of the intestine in general, would not be anticipated and would not be readily explained. Eosinophilic infiltration has been observed in association with pyloric obstruction and recurrent blood eosinophilia. The nature of the disease process was not clear (10).

Acute inflammation has been observed gastroscopically to follow the controlled introduction of food substances commonly regarded as allergens (8). The repeated ingestion of offending substances of this type might explain some cases of chronic

[1] From the Laboratory Service, Veterans Administration Hospital, and The Department of Pathology, University of Colorado School of Medicine, Denver, Colo. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

gastritis, through the cumulative residual effect of multiple acute episodes.

Another possible etiologic factor inviting exploration is viral infection. The latter is of increasing importance in diseases affecting the viscera throughout the body. In some viral diseases, such as poliomyelitis, the alimentary tract is involved, as shown by recovery of virus from the stool, and the mucosa throughout the tract may show lymphocytic infiltration. Although most viral infections are acute or subacute, smouldering viral processes are implicated with increasing frequency. Viral studies of the gastric tissue may offer promise. One encounters a potential difficulty in that (and this is purely hypothetical) in certain chronic processes thought to be viral, the virus may possibly have too close an affinity with the host tissue to allow recovery by animal inoculation or culture on chick embryo.

Drugs have been implicated, as for example cincophen, used experimentally in dogs (1). Endocrine disorders have been placed among the possible offenders (4).

Extension of the list of possible etiologic factors is limited only by the fertility of imagination of the contributor and indicates the paucity of well controlled data. The foregoing examples have been offered, not because they are well substantiated, but only to show how little has been done, and how wide is the field.

One important etiologic factor (perhaps no more securely documented than the others) remaining to be discussed is the neurogenic. In the view of some workers (2)—and the writer is inclined to concur—this is the outstanding causative mechanism in chronic hypertrophic gastritis, of one type at least. The essential or initiating mechanism is thought to be vagal hyperfunction, under the influence of the hypothalamus, and doubtless influenced in a measure by cortical impulses. Duodenal ulcer has been reported (7) in association with lesions, especially tumors and injuries, of the hypothalamus, but actually gastric ulcerations of this type are preponderantly numerous and severe. Distinction is not made between vagal hyperfunction in gastric and in duodenal ulcer. Smoking may have an effect by means of synaptic interruption of impulses which normally pass through inhibitor sympathetic ganglia.

The intermediate pathogenetic mechanism of the neurogenic factor is excessive gastric secretion of acid and pepsin, together with hypercontractility, the latter not only initiating a train of kinetic disarrangement, but also interfering with circulation to the gastric tissue. The relatively ischemic tissue is particularly vulnerable to excessive acidity. Mucinous secretion may be poorly balanced against acid and pepsin. In its more acute and fulminating form, the mechanism may lead to actual gastric necrosis, even resulting in perforation. Regarding this phenomenon, doubt can no longer exist. In addition to the foregoing, the effect of muscular hypercontractility in producing gross structural abnormality of the various components of the gastric wall must be considered.

If the neurogenic mechanism does occur, there must be a stage or type of reaction in which, although inflammation, fibrosis, and other related pathologic changes have not as yet appeared, the structural outlines may be disordered (*i.e.*, enlarged rugae). In many such cases, when the stomach is removed, the structural changes may disappear, and the pathologist may not see the specimen in its original condition unless he has the opportunity, and takes it, to observe the findings of his clinical colleagues (*i.e.*, at gastroscopy, or *in situ* during surgical exploration).

Eventually, however, more permanent pathologic changes occur. The basic pathogenetic mechanism is that of injury of tissue (on the basis described earlier), with inflammatory reaction leading to varying combinations and degrees of ulceration, fibrosis, and hypertrophy. There may be pyloric obstruction, and the mucosal prolapse described previously may be encountered.

The first stage of tissue reaction appears to be edema and congestion. The latter,

contributed to by vasoparalysis, may lead to hemorrhages of variable size; gastric mucosal petechiae, with minor tissue loss, are extremely common (9). Mucosa, but especially submucosa, is particularly involved by the edema and congestion. In more acute episodes (and some feel that chronic hypertrophic gastritis is the result of repeated acute episodes), there may ensue polymorph infiltration, but the infiltration more often is lymphocytic. Lymphocytes gather in cumulative fashion in mucosa and submucosa, and newly formed follicles may appear. The muscularis is less heavily involved by inflammatory infiltrate; however, this layer is edematous and in time is thickened from hypertrophy. In some cases, this is especially true of the pyloric sphincter and adjacent muscle.

The injured mucosa heals with production of an atypical and irregular pattern. The surface acquires a "cobblestone" outline. The glands become irregular, with the formation of cystic acini, particularly in the deeper portion of the mucosa, and the cells may become hyperchromatic, so that in some instances the picture resembles carcinoma in a measure. The normal secretory cell types may, further, give way to a mucinous type, often simulating the structure found in the large intestine. In the more severe cases, the mucosa may become polypoid. Although hypertrophy is the outstanding feature, tissue loss may sometimes end in atrophy, though, more often than not, this is only focal rather than affecting an individual stomach throughout. Atrophy may represent healing of an ulcer.

Edema tends to persist in the submucosa, owing in important measure to traction on the rugae, attendant on peristalsis and pyloric hypertonicity. The tissues lose their pliancy. This condition is aggravated by alteration of the muscularis mucosa, which hypertrophies and, in time, is split and disorganized, and becomes fibrosed. Submucosal blood vessels become thickened and sclerotic, and this may enhance the ischemic condition.

Along with the tendency toward persistence of edema of the submucosa, fibrosis may appear, especially as the lymphocytic infiltrate recedes and gives place to other elements. The observation is often made, apart from any consideration of chronic hypertrophic gastritis, that lymph nodes in general may, in atrophy, be replaced by fat. Similarly, the regressing submucosal lymphoid tissue in chronic gastritis may be replaced with adipose tissue, thus militating against regression of mural thickening. As the process continues, the rugae may increase in height and width until they resemble cerebral convolutions, and may appear roughened and polypoid (6).

At the pylorus, the expulsive force is exerted on the redundant rugae, which may prolapse into the duodenum. The prolapsing mucosa (the object of increasing interest) may contribute to the obstruction of the spastic, thickened, and indurated pylorus. Prolapsing gastric mucosa and chronic hypertrophic gastritis thus appear closely related and commonly are present simultaneously. Whether one causes the other is open to discussion. That prolapse of mucosa could arise on a basis of disordered motility seems likely. Muscular hypertrophy, together with inflammation and fibrosis, doubtless will contribute to the permanence of the prolapse.

In either stomach or duodenum, tissue injury may lead to frank ulceration. Whether inflammation produces ulcer, or ulcer induces gastritis, is beside the point. What is important is that tissue is injured; it may break down and ulcerate or may show inflammation, or both may occur.

Chronic hypertrophic gastritis, duodenitis, and gastric and duodenal ulcer thus are regarded as manifestations of the same general process. Localization and type of injury and repair are affected by local factors, such as variation in vascular architecture and in tissue resistance.

Especially in the pyloric region, the hypertrophied muscularis may join contiguous submucosa in fibrosis; in this way, the firm ring of tissue is formed which

is encountered in the condition referred to as antral gastritis (2). The fibrotic, thickened prepyloric muscle may lead toward the hypertrophied pyloric sphincter as a gradually thickening cuff, incorporating the sphincter, or in some cases ending just proximal to the sphincter, leaving a small intervening notch or segment of muscularis which is of relatively normal thickness.

The proximal portion of the stomach may appear relatively normal; more often, there is at least some degree of chronic inflammation, and this may be marked. The mucosal surface shows nodular irregularity. The intrinsic mucosal structure may be altered; except in cases of atrophy, the parietal cells appear reasonably numerous and capable of formation of acid. Lymphocytic infiltration may appear, especially in mucosa and submucosa. The submucosa may be edematous and fibrosed, and muscularis mucosae and propria may be thickened, with variable degrees of fibrosis.

SUMMARY

Chronic hypertrophic gastritis, antral gastritis, prolapsing gastric mucosa, chronic duodenitis, and gastric and duodenal ulcer appear in many cases to be manifestations, often coincidental and in varying measure overlapping, of one main underlying constitutional disturbance: vagal hyperfunction. The problem of etiology and pathogenesis of these pathologic conditions, however, appears largely unsolved, and requires extended and adequately controlled investigations, based on the well integrated efforts of internists, radiologists, gastroscopists, surgeons, pathologists, and experimental workers.

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SUMARIO

El Problema de la Patogenia de la Gastritis Hipertrófica Crónica

La gastritis hipertrófica crónica, la gastritis antral, el prolapso de la mucosa gástrica, la duodenitis crónica y la úlcera gástrica y duodenal parecen, en muchos casos, ser manifestaciones, a menudo coincidentes y más o menos sobrepuestas, de una fundamental y subyacente perturbación orgánica: hiperfunción del neumogástrico.

El mecanismo patógeno intermedio es hipersecreción de ácido y de pepsina, unida a hipercontractilidad, iniciando la última no solo una serie de desarreglos cinéticos, sino también una perturbación de la circulación en el tejido gástrico. El tejido relativamente isquémico es en particular vulnerable a la hiperacidez. La lesión histológica con reacción inflamatoria conduce a varias combinaciones y grados de ulceración, fibrosis e hipertrofia.

El problema de la etiología y patogenia de los precitados estados patológicos parece, no obstante, estar todavía en gran parte irresuelto.

DISCUSSION OF SYMPOSIUM ON GASTRITIS

(Papers by Curtis, Berg, Stampfli, Ingersoll, McGlone, Kennedy, Larson and Kling, Dublin)

Ross Golden, M.D. (New York, N. Y.): You will agree, I am sure, that we have been privileged to hear a most imposing symposium. It is quite a job to open the discussion. Any one of these papers would be sufficient to stimulate very active and interesting comment. Although, as Dr. Curtis said, this topic is not new, it is always timely.

Cruveilhier in France, more than one hundred years ago, published a drawing of a specimen which he labeled "narrowing of the pylorus," which I think shows clearly evidence of hypertrophy of the pylorus and to some extent of the prepyloric muscle.

The essayists have mentioned the phenomenon of retraction of the mucous membrane of the antrum as the antral systole closes down. This I believe must be a normal and important part of the expulsive movement of the antrum. The gastroscopists say that they see this rather frequently. We can see evidence of this retraction by x-ray only under special conditions, when some kind of landmark on the surface of the mucous membrane is present, either a small polyp or a polypoid elevation of the mucosa which cannot be compressed by the peristaltic constriction.

I am glad that Dr. Stampfli emphasized the fact that the roentgen examination and gastroscopy are not rivals but are complementary methods. Each can do what the other cannot.

Mention was also made of the difficulty of differential diagnosis of antral gastritis from ulcer. This does not strike me as a question of differential diagnosis. An ulcer may or may not be present with antral gastritis. The ulcer is not infrequently located proximal to the spastic area of the antrum.

On the other hand, the differential diagnosis of carcinoma and of antral gastritis is a really difficult problem. As we gain experience in examination of the stomach, each of us must develop in his own mind certain criteria which in his experience favor one of the other of these interpretations. If we are not sure, re-examination after a period of treatment of perhaps three weeks is indicated, and in some instances even further re-examination after six weeks, three months, etc., may be indicated. In cases with gastric retention, in my experience, gastric lavage with a sodium bicarbonate solution every night about ten o'clock has been valuable because it leaves the stomach empty and at rest. Patients may be taught to wash out their own stomachs at home. In my experience, also, in cases of advanced antral gastritis, treatment is not usually followed by much relaxation of the spasm. Dr. Walter W. Vaughan has previously published some cases in which relaxation under treatment has occurred, but in my experience this is rare. On the other hand, I have found that an increase in the spasm is suggestive evidence that carcinoma is present. If I see evidence of an increase in the spasm of the antrum on repeated examination, I do not hesitate to recommend operation.

Mention was made this afternoon of the danger of withholding operation because of the difficulty in determining whether carcinoma is present. I believe that an experienced surgeon who knows he is working with an experienced radiologist will operate on a patient if the radiologist tells him that the evidence favors the presence of carcinoma, although a positive interpretation cannot be made. We must remember that a carcinoma can develop in the presence of antral gastritis where the inflammation may have been present for years. It is impossible to rule out carcinoma. All we can say is that certain evidence of a malignant growth cannot be demonstrated.

A number of comments have been made about the etiology of antral gastritis. The possibility of allergy and of a neurogenic mechanism has been mentioned. Unfortunately these two conditions may well go together. Kuntz in his important book on the autonomic nervous system regards allergic phenomena as based on parasympathetic hyperactivity which, of course, might alone be responsible for spasm of the prepyloric region. The nearest analogy to hypertrophy of the pyloric and prepyloric muscle that I can think of is the hypertrophy of the bronchial musculature in chronic asthma. I wonder whether we should not follow the lead of Dr. Ritvo and use drugs in whipping up peristalsis in some of these spastic antrum cases where it is so difficult to tell whether the wall is infiltrated. The French workers are using morphine intravenously for this purpose. Hyperactive peristalsis stimulated by drugs might in some cases give us additional evidence concerning the stiffness or flexibility of the stomach wall. We probably need better drugs, however, than those available at the present time.

Some of the essayists discussed technic. My experience suggests the advisability of taking films with the patient on the fluoroscopic table, using an overhead tube. These films of course are in addition to the spot films. Some films with only a little barium in the stomach to show the mucosal pattern, and then films after the stomach is filled with barium to stimulate peristalsis, are necessary. I like to take these films myself with the assistance of an aide, and thus make certain that I will have films in exactly the correct positions.

In conclusion, I know that you all agree with

me that the films we have seen and the nice scientific exhibit on this topic indicate that these workers are doing excellent gastric radiology. I am sure that both the doctors who use them as consultants and the patients who go to them are to be congratulated on having such good radiology available.

Walter W. Vaughan, M.D. (Durham, N. C.): Dr. Curtis has made a very complete survey of the literature and has emphasized the fact that a certain percentage of these gastric lesions can be correctly diagnosed only by removal of a portion or all of the stomach.

Dr. Berg has given an excellent discussion of antral gastritis. Although I do not have any statistics from our department, I believe that the incidence corresponds very closely. I would like to emphasize further the difficulty in differentiating antral gastritis from other prepyloric lesions. It is not always possible to trace the rugae through the involved area, as was suggested by Dr. Berg. This is especially true in the acute edematous gastritis where there is a filling defect which often cannot be distinguished from a prepyloric neoplasm on the initial roentgen examination.

Massive hemorrhage from antral gastritis is not too uncommon and in such cases, if a satisfactory gastroscopic examination can be done within a few days, superficial areas of ulceration may frequently be demonstrated.

Dr. Stampfli has outlined a technic for roentgen examination of the stomach that is extremely meticulous and approaches the ideal for study of the gastric mucosa. Most of us are familiar with the abnormal mucosal pattern which he has described and so well illustrated in the series of cases presented; however, many of us are guilty of neglecting the detailed study as outlined in this presentation. Dr. Stampfli thinks that the forms of gastritis which produce x-ray changes are most likely to produce symptoms. This is not always true, especially in atrophic gastritis.

The importance of adequate follow-up studies in all these patients in order to exclude the possibility of an underlying neoplasm cannot be overemphasized.

I am unable to accept the theory proposed by Dr. Ingersoll that all gastritis begins as a result of prolapsed gastric mucosa. All gastroscopists have seen localized areas of gastritis proximal to the incisura angularis with superficial ulceration and an entirely negative antrum and pylorus both roentgenologically and gastroscopically. I *do* believe that chronic enlargement of the mucosal folds, the so-called giant rugae, will show microscopic evidence of disease.

I disagree with Dr. McGlone that the most practical aspect of gastritis is where a differential diagnosis between benign and malignant process is necessary. From the standpoint of the patient, it is as important to make the correct diagnosis in gastritis as it is in benign gastric and duodenal ulcer. Hemorrhage and perforation may complicate the process and, too, in a certain number of these cases the disease is progressive and subtotal gastric resection is indicated as early as possible. The percentage incidence of carcinoma developing on gastritis is unknown but probably is extremely low.

Dr. McGlone states that enlarged mucosal folds in the cardia have been due to neoplasm or simple enlargement of the folds in this region. In our experience we have seen several patients with marked gastritis in the cardia and two of these died of massive hemorrhage which was confirmed by autopsy. A third case has been previously reported where the findings were confirmed by a subtotal resection.

Dr. Kennedy apparently does not have the sentimental attachment for his stomach that some of us possess or else he would be more reluctant to recommend immediate surgical intervention in all gastric lesions that present any x-ray findings that might indicate either a benign or malignant process on the initial examination. It is true that the present operative mortality for subtotal gastric resection is less than 1 per cent for benign lesions; however, it is also true that many of these gastric lesions will clear completely within two to three weeks on a strict medical regime, especially such lesions as an acute edematous antral gastritis. Obviously the mortality from malignant disease due to delay in surgery for two to four weeks in these borderline cases will not be increased significantly.

I agree with Drs. Larson and Kling that no better classification of gastritis is available at present and probably will not be until there is a better understanding of the etiology. Since these two terms, chronic atrophic and hypertrophic, do not cover all cases, they have added a third superficial gastritis, which has been used by gastroscopists for several years. In the past a number of other descriptive terms have been used in connection with gastritis, as these authors have pointed out.

It seems likely that all of these forms of gastritis which are of obscure etiology are actually different anatomical and histological manifestations of the same disease process. In a study of a number of cases of gastritis we observed transformation of one type into another, and Drs. Larson and Kling have mentioned that in the same stomach more than one anatomical form of gastritis may exist at the same time.

Atrophic gastritis shows thinning of the mucosa, shortening of the glands, and an apparent decrease in the number of glands. Hypertrophic gastritis has exactly the opposite changes in the glands. But aside from this, the microscopic

features of gastritis are fundamentally the same whether the glands are atrophic or hypertrophic.

In our study we found that cellular infiltration of the mucosa is difficult to evaluate and that epithelial changes in the glands are more helpful in evaluating the presence of disease in the mucous membrane. However, if heavy leukocytic infiltration is observed in more than the superficial one-third of the gastric mucous membrane, it is probably abnormal. Also any significant infiltration of the muscularis mucosae, submucosa, or muscularis may be regarded as abnormal.

The classification of gastritis used in our hospital is essentially the same as that recommended by Drs. Larson and Kling.

Dr. Dublin discusses the more prevalent factors and theories to explain the etiology of hypertrophic gastritis. As he points out, hypertrophic gastritis is probably not the result of any one factor such as irritants, allergy, bacteria, toxins, and viral infection, but is most probably on a neurogenic basis. This would appear as though nervous control of contractibility, secretion, and circulation makes a fertile place in the stomach for exogenous insult. That this is of hypervagal stimulation is still speculative because of the results found in vagotomy and more recently by the use of Banthine. Possibly an explanation for some of the poor results from vagal inhibition is that the stomach has, in chronic cases, lost the ability to recuperate and handle ordinary exogenous insults.

The pathogenesis of the disease is covered very well and the author points out that this disease process cannot be separated from ulcers, either gastric or duodenal. That the type of lesion an individual develops is related to variations in the etiology seems quite reasonable.

Calcifying Tendinitis of the Shoulder

A Critical Study of the Value of X-ray Therapy[1]

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MANY REPORTS have been published on the various methods of treatment of painful calcifications in the region of the shoulder joint. Some authors advocate needling, irrigation, or surgical excision. Others regard x-ray therapy as the procedure of choice. About 35 papers discussing the value of roentgen therapy have come to our attention since this method was first proposed in the European literature (1, 2, 3) and publicized in America by Lattman (4) and de Lorimier (5). The methods have varied from single very small doses to repeated or prolonged intensive courses of low- or high-voltage radiation. Seventy to 100 per cent of patients have reportedly benefited from irradiation.

Occasional voices of skepticism as to the efficacy of radiation therapy have found expression in print: Guido (6) states that "the condition is sometimes self-limited and a few of the patients will obtain relief at least temporarily without any form of therapy." Two of 11 patients in his series had complete remissions without treatment. Newell (7), discussing Baird's paper (8), said: "I have known calcium to disappear in a number of patients that were seen in the acute stage and were given no x-ray treatment. It is possible, therefore, that part of the clearing out of the calcium is due to the patient's reaction and not to the irradiation." Klein and Klemes (9) observed spontaneous gradual absorption of calcification without therapy in 12 per cent of their cases. Twenty-five patients treated with physiotherapy alone had an average period of disability of fifty days compared with ten days for 27 patients also receiving x-ray therapy. Unfortunately, these data were not derived from a controlled study of unselected patients. Pendergrass and Hodes (10) found that "ordinarily, the acute symptoms subside in one or two weeks without treatment. The usual course in patients benefited by irradiation is less than one week."

The mechanism by which x-rays are believed to exert a beneficial effect on the calcified tendon is not known. Reference to some of the many theories is made by a number of authors, particularly in the excellent discussions by Borak (11) and Roxo Nobre and de Araujo Cintra (12). To our knowledge, no truly controlled series has been published. The present paper reports a controlled study of the effect of x-ray therapy on 38 patients with peritendinitis of the shoulder.

DIAGNOSIS

Calcifications in the tendinous insertions or in the bursa are easily demonstrated by means of films of the shoulder in external and internal rotation of the humerus. The facets for insertion of the four shoulder muscles which are prone to calcify are outlined by pieces of lead foil on a right humerus in the two standard projections (Fig. 1). The insertions of the teres minor and subscapularis muscles may overlap completely in external rotation but will easily separate in internal rotation. In this projection, the three facets of the supraspinatus, infraspinatus, and teres minor will face posteriorly, while that of the subscapularis will turn anteriorly (Fig. 1A).

Calcium in the bursa can often be distinguished from calcified tendons. The

[1] From the Department of Radiology, University of Utah Medical School. Presented at the meeting of the Rocky Mountain Radiological Society, Denver, Colo., in August 1951. Accepted for publication in January 1952.

bursa extends 2 to 3 cm. below the greater tuberosity and forms a rounded blind pouch at its lower end. It may extend over 2 to 3 cm. in width and, if filled with calcium, may be seen to cover the entire area of the greater tuberosity by a thin layer of density. The calcium-containing bursa can be identified to best advantage in the position of external rotation (Fig. 3B)

LIFE HISTORY OF THE DISEASE

From our observations on many of the treated as well as the untreated patients, the life history of the disease would seem to be as follows: As calcium accumulates in the diseased tendon, which may occur in a matter of a few days, the tendon sheath will be under tension and the patient will experience severe pain. In many acute cases, the tendon ruptures and the calcareous material is discharged into the bursa. Coincident with this event, the acute pain usually ceases or diminishes rapidly. Calcium in the bursa often absorbs readily in a matter of days or weeks.

In chronic cases, the accumulation of calcified necrotic material in the tendon is neither rapid nor extensive enough to lead to rupture. Discharge of only part of the calcareous material into the bursa in some cases is not accompanied by complete relief.

MATERIAL AND METHODS

Thirty-eight patients are included in this study, of whom 21 were treated and 17 served as controls. Both groups were subjected to the same procedure: The patient was placed in a sitting position in the deep-therapy room, the tube was angulated against the diseased shoulder and treatment was given through one field of 10 × 10 or 10 × 15 cm. The treatment factors were: 400 kv.p., 2 mm. Cu plus 1 mm. Al filter, h.v.l. 3.75 mm. Cu, 5 ma., 16.2 r/min. in air, at 70 cm. focal skin distance. In the control series, a 5 mm. lead shutter prevented any radiation from escaping outside of the tube housing. A dose of 150 r in air was given three times on alternate days. The control cases

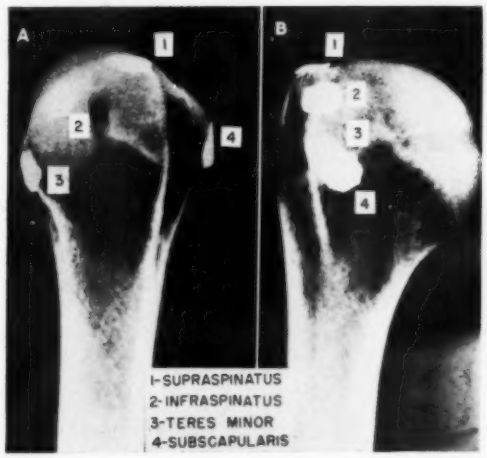

Fig. 1. Tendinous insertions of the head of the humerus. A. Internal rotation. B. External rotation.

were selected at random, by the "flip of a coin" method.

Patients were observed for a period of six weeks following therapy. The average age of the 21 treated patients was 50 years, that of the 17 untreated patients was 48.8 years. Sixty-two per cent of the treated patients and 59 per cent of the untreated were females. The occupations of 30 patients are recorded in Table I.

TABLE I: AGE, SEX, AND OCCUPATIONS OF PATIENTS

	Treated	Untreated
Number of cases	21	17
Average age	50 yr.	48.8 yr.
Sex		
Male	38%	41%
Female	62%	59%
Occupations	Housewife, 10 Nurse, 2 Composer, 1 Insurance, 1 Office worker, 1 Retired, 1 Not stated, 5	Housewife, 8 Office worker, 3 Broker, 1 Engineer, 1 Professor, 1 Not stated, 3

DURATION OF SYMPTOMS

Essentially, two types of pain could be distinguished: severe acute pain and subacute or chronic pain. The latter type often preceded the former by several days or weeks. The average duration of pain in the treated group was eleven months and four days; in the untreated, thirteen

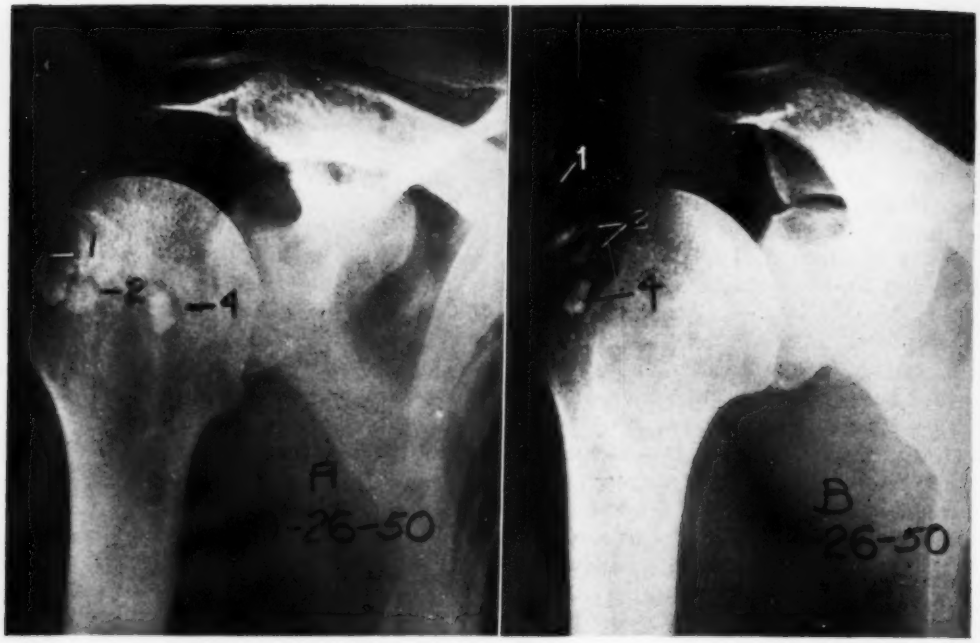

Fig. 2. Calcification in supraspinatus (1), infraspinatus (2), and subscapularis (4) tendons. A. Internal rotation. B. External rotation.

The patient was a 61-year-old male complaining of occasional pain in his left shoulder for several years. Severe pain and inability to abduct the arm had been present for the past three weeks. The patient failed to return to the clinic following x-ray examination and received no treatment. Six days later he was much improved. Complete range of motion was restored two months following the first visit on Sept. 26.

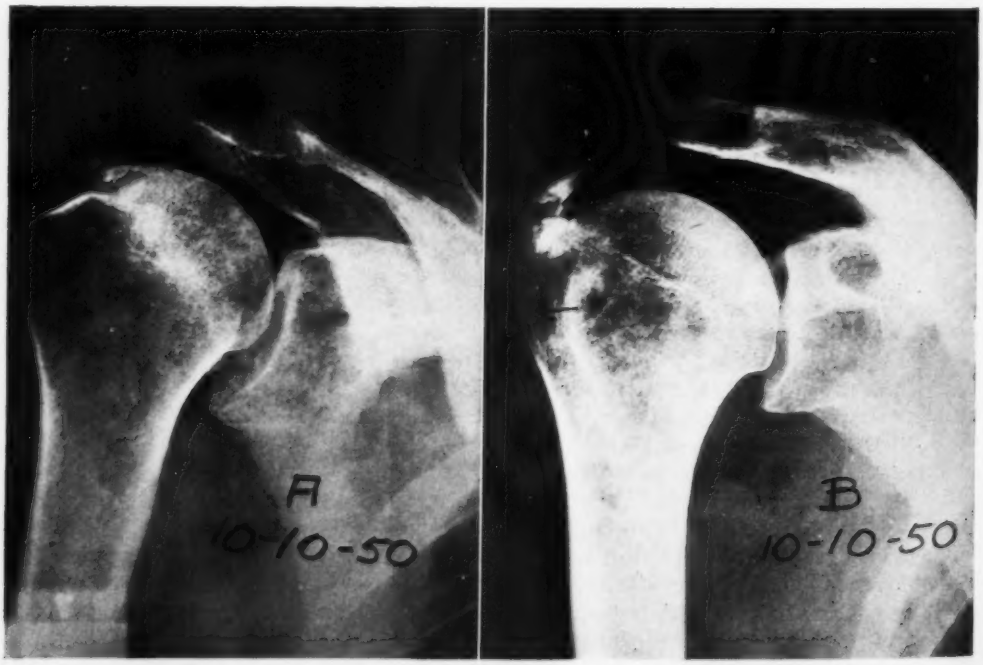

Fig. 3. Patient shown in Fig. 2 fourteen days later. Calcification in the tendons had decreased appreciably. Calcium now outlines the bursa on the film in external rotation.

months and ten days. The average duration of acute pain for the two groups was fifteen and sixteen days, respectively.

Table II gives information as to the side affected, the frequency of a history of trauma, limitation of motion, and whether or not narcotics were required.

TABLE II: CLINICAL OBSERVATIONS IN TREATED AND UNTREATED PATIENTS

	Treated	Untreated
Side affected		
Right	14	12
Left	7	5
History of trauma	2	4
Limitation of motion	11	8
Narcotics required	5	7

CALCIFICATION

Calcification, most common in the supraspinatus tendon, was found with equal frequency in the control (14 cases or 82 per cent) and treated groups (17 cases or 81 per cent). In three (14 per cent) of the treated group, calcification could be localized in the tendon of the infraspinatus muscle. The teres minor and subscapularis were not found to be affected in any of these cases. Calcification in the bursa occurred in 29 per cent of the patients in each group. No calcification could be demonstrated in 1 patient (5 per cent) in the treated group and in 3 untreated patients (18 per cent) (see Table III).

TABLE III: CALCIFICATION IN TREATED AND UNTREATED PATIENTS

	Treated	Untreated
In tendons		
Supraspinatus	17	14
Infraspinatus	3	0
Teres minor	0	0
Subscapularis	0	0
No calcification	1	3
In bursa	6	5

RESULTS

All patients were observed for a minimum period of six weeks. Beneficial results were judged on the basis of increase in the range of motion or complete restoration of normal motion and partial or complete relief of pain occurring within the six-weeks period of observation. Complete range of motion was restored within six weeks in 7 of the treated patients, and in 7 of the pseudo-treated patients. The remaining patients in both groups experienced little or no improvement in this respect. Definite improvement or complete relief of pain within a period of six weeks after therapy was experienced by 15 of the treated and 15 of the control patients (Table IV). The difference between the two groups is not significant. The total of "relieved and improved" was very similar in the acute and chronic cases in the two groups. However, the percentage of patients obtaining complete relief was higher in the acute than in the chronic cases.

TABLE IV: EFFECT OF TREATMENT ON PAIN

	Treated Patients	Untreated Patients
Total cases	21	17
Unimproved	6	2
Improved	9	7
Relieved	6 (15)	8 (15)
Acute cases	11	10
Unimproved	3	1
Improved	5	2
Relieved	3 (8)	7 (9)
Chronic cases	10	7
Unimproved	3	1
Improved	4	5
Relieved	3 (7)	1 (6)

Sixteen treated and 12 untreated patients were re-examined within a period of one month following the first visit. The data in Table V represent the findings relative to calcification in this group. The bursa contained a visible amount of calcium in 29 per cent of the patients in each group on the first examination. On re-examination, this had decreased in amount in all patients, treated or untreated, and had disappeared completely in 2 patients (both untreated). In 9 (56 per cent) of the treated and in 4 (33 per cent) of the untreated patients, there was no appreciable change in the size or density of the calcium deposits in the tendons; in 7 (44 per cent) treated and 8 (67 per cent) untreated, calcium deposits decreased or disappeared completely. Figures for acute and chronic cases considered separately are also shown in Table V.

TABLE V: EFFECT OF TREATMENT ON CALCIFICATION

	Treated Patients		Untreated Patients	
Total cases	16		12	
Unchanged	9		4	
Decreased	7		6	
Disappeared	0		2	
Acute cases	9		8	
Unchanged	5		1	
Decreased	4	4	5	7
Disappeared	0		2	
Chronic cases	7		4	
Unchanged	4		3	
Decreased	3	3	1	1
Disappeared	0		0	

The time required for definite improvement or complete relief of symptoms following the first visit averaged eleven days in both treated and control groups.

DISCUSSION

The life history of any disease which will respond equally well to many forms of treatment and to a wide variety of technics needs careful scrutiny. We have attempted to control this study as carefully as possible.

The results indicate that a high percentage of patients with calcifying tendinitis of the shoulder will improve rapidly regardless of the form of treatment employed. The results in the control group actually appeared to be better than in the treated group. Statistical analysis[2], however, reveals that this difference is not significant and that it should not be inferred that healing was delayed by x-ray therapy.

X-ray therapy cannot be credited with shortening the period of disability in our study, since an average of eleven days was required for definite improvement or relief in the treated as well as in the control series.

CONCLUSIONS

In spite of several obvious shortcomings of this study, such as the small number of patients, the fact that the same observer administered x-ray therapy and assessed the clinical results, and the relatively short observation period, we are forced to conclude that calcifying tendinitis of the shoulder is essentially a self-limiting disease. We have not been able to demonstrate that radiation therapy exerts a beneficial effect on its course or duration.

It is hoped that this study may encourage other therapists to scrutinize the results of radiation therapy of this and other benign conditions. Larger well controlled series with long-term follow-up should separate the diseases which are really helped by radiation therapy from others in which the treatment may represent only an unnecessary exposure of a patient to radiation.

SUMMARY

1. Thirty-eight patients with the syndrome of peritendinitis of the shoulder were placed under an x-ray machine. In 17 of this number a 5-mm. lead shutter was left in place during treatment, without the patient's knowledge, so that he received no radiation.

2. Equally satisfactory results were obtained in the treated and the control groups; 15 of the 21 treated patients experienced partial or complete relief while 15 of the 17 patients in the shielded control group obtained similar beneficial results. In 7 of the treated and 7 of the shielded patients, restoration of motion of the shoulder was complete at the end of the observation period of six weeks. The average period required for improvement or relief of symptoms following therapy was eleven days in each group.

NOTE: I wish to express my appreciation to Lowell Woodbury, Ph.D., of the Department of Physiology, who was kind enough to subject the data presented to statistical analysis.

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[2] The data were analyzed by Fisher's exact method for fourfold contingency tables. The hypothesis under test was that x-ray treatment had no effect. The data suggest that, in fact, it had a faint detrimental effect. The probability that an effect of this size or greater could arise by pure chance was found to be 0.2 or one out of five. In other words, the hypothesis of no effect was not disproved.

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SUMARIO

Tendinitis Calcificante del Hombro. Estudio Analítico del Valor de la Roentgenoterapia

Treinta y ocho enfermos con el síndrome de peritendinitis del hombro fueron colocados debajo de un aparato de rayos X. En 17 de ellos, se dejó colocado, sin que lo supiera el paciente, un obturador de 5 mm. de plomo, de modo que aquel no recibió radiación.

Obtuviéronse resultados igualmente satisfactorios en los grupos tratado y resguardado: 15 de los 21 enfermos tratados manifestaron alivio parcial o total, en tanto que 15 de los 17 testigos resguardados obtuvieron beneficio semejante. En 7 de los tratados y 7 de los resguardados, la recuperación de la movilidad del hombro era completa al terminar el período de seis semanas de observación. El plazo medio requerido para mejoría o alivio de los síntomas fué de 11 días en ambos grupos.

Results of Radiation Therapy for Bronchogenic Carcinoma

A Statistical Analysis of 125 Cases[1]

BERNARD P. ADELMAN, M.D.

THE ROLE OF radiotherapy in bronchogenic carcinoma has been the subject of numerous articles over many years. Opinions concerning its efficacy have varied widely, from those seemingly overoptimistic in their claims to others acknowledging with despair the complete futility of irradiation as a curative agent for cancer of the lung. It is, however, true that in recent years the best opinions have been that in radical surgery lies the only hope for cure, with irradiation assuming a secondary, palliative role in those cases where operative extirpation is impossible.

The considerable morbidity subsequent to intensive pulmonary irradiation is well known; therefore, worth-while results from the standpoint of increased longevity and decreased symptomatology must logically be expected before this agent is empirically employed. In an attempt to determine what results may be expected, particularly from the point of view of survival following treatment, this study was made.

MATERIAL

Available for this study were 216 cases seen in the Radiotherapy Department of Temple University Hospital from 1931 to 1949 inclusive. In only 152 patients was x-ray therapy directed toward the primary lesion. An additional 27 cases were excluded from the statistical survey of irradiation results, having received only token doses, and having died very early in the course of treatment. We are aware that we may be subject to criticism for this deletion, but feel that the general validity of our results is unimpaired. Actually, inclusion of this group would strengthen the conclusion reached, but before starting the statistical survey we believed that it would unduly weight the results. The outcome of a course of treatment cannot truly be analyzed if the patient dies before completion of that course, particularly if the total dose administered is small and insignificant. It may be that some of these patients might have lived longer, but they did not have time to benefit from the treatment. It is with the remaining group of 125 patients that this report is primarily concerned.

CLINICAL AND PATHOLOGIC FEATURES

The group as a whole manifested features quite similar to those observed in other surveys. We, too, have found an increased incidence of bronchogenic carcinoma in recent years, although we are not prepared to state whether this is real or apparent. The average age for all our patients was fifty-four years, with the mean for females (49.1 years) significantly lower than that for males (54.6 years). Adenocarcinoma was more frequent in the younger age group, probably because of malignant degeneration of bronchial adenomas, lesions more common in young adults. The age extremes were 20 and 74.

Males of course predominated, with 89.8 per cent of the cases occurring in that sex. Adenocarcinoma appeared somewhat more frequent in females. Thirteen cases were found in Negroes and 2 in Japanese males. Negroes constituted only 6 per cent of our series, but this figure cannot be considered important, since private referrals predominate in this institution.

Tumors were more common on the right side and in the upper lobes. The most common histologic variety was the squa-

[1] From the Department of Radiotherapy, Temple University Medical School and Hospital, Philadelphia, Penna.
Abridgment of a thesis submitted to the Faculty of the Temple University Medical School in partial fulfillment of the requirements for the degree of Master of Science in Radiology. Accepted for publication in January 1952.

mous-cell lesion, which accounted for approximately half the cases.

The average time elapsed from onset of symptoms to diagnosis was 6.5 months. The usual syndrome, with cough predominating, was noted. Bronchoscopy was in our series the most valuable method of obtaining material for histologic diagnosis, with aspiration biopsy also of great importance. The most common site of metastasis was the mediastinum, with the skeleton, pleura, liver, brain, cervical nodes, lungs, supraclavicular nodes, and other sites following in that order.

RADIATION THERAPY

As far as actual prolongation of life following radiotherapy is concerned, reports are conflicting. Most observers have felt that there is an apparently definite increase in life expectancy compared to that of untreated cases. But one highly significant fact must not be overlooked. The great majority of untreated cases are those in which the disease is so far advanced and the condition of the patient so poor that radiotherapy is withheld. Conversely, those treated intensively are usually in fairly good condition. It is not surprising, therefore, that published statistics should show an increased life expectancy in the treated group. Whether or not life is actually prolonged by irradiation might conceivably be determined only if some large series of cases were reported in which treatment had been either given to or withheld from alternate patients, regardless of their status, so that a truly unsampled and unselected statistical survey might be made. However, we advocate no such procedure; it would mean that too many patients deserving therapy would go untreated, while others would be subjected to a prostrating course of therapy contraindicated by their condition and hopeless state. It is interesting to note that, while investigators have uniformly reported an apparent prolongation of life in treated cases, all have hesitated to attach any great significance to the finding.

Our technic of irradiation has not changed greatly in the twenty-year period covered by this survey. The factors employed have varied as follows: 160 to 250 kv. (constant potential), 8 to 15 ma., 50 to 70 cm. target-skin distance, and filtration from 0.5 mm. Cu plus 1.0 mm. Al to 2.0 mm. Cu plus 1.0 mm. Al. Early cases were treated in many instances by the old saturation technic. The present irradiation factors are 250 kv. (constant potential), 15 ma., 50 cm. or 70 cm. distance, and added filtration of 0.5 mm. Cu plus 1.0 mm. Al. The lesser filtration is now employed exclusively. It is more economical of time, and we have not found that the higher filtration has improved results. The half-value layer of the radiation delivered is 1.7 mm. Cu. Where therapy is strictly of a palliative nature, a 50-cm. distance, again more economical of time, is employed. Where there is a reasonable hope of some lengthy survival, we have used the 70-cm. distance for its greater percentage depth dose. All cases at present are treated by the protracted fractionation technic. In strictly palliative cases, two portals are employed, anterior and posterior, occasionally with a third lateral portal. In smaller lesions, we have attempted to cross-fire with as many as eight smaller portals, using the Demy localizer. Usually, two portals are treated daily, receiving air doses of 200 r each. For palliation, we have usually stopped at 2,000 or 3,000 r in air to each portal. For the occasional more hopeful case, we have attempted to deliver a tumor dose of 5,000 r.

PROGNOSTIC FACTORS

Age of Patient at Onset of Disease: There does not appear to be any definite correlation between age of onset of disease and total duration of life. The three principal age groups, 40–49, 50–59, and 60–69, showed almost identical periods of survival from the onset of symptoms to death.

Duration of Symptoms Prior to Diagnosis: Although the importance of early diagnosis of bronchogenic carcinoma is incontro-

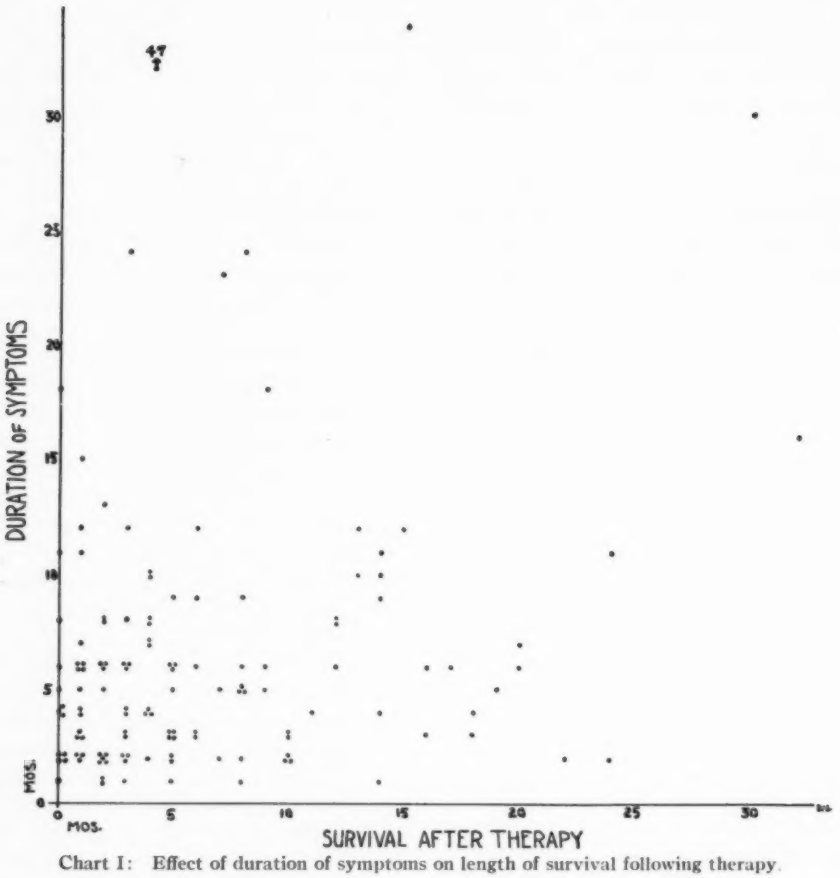

Chart I: Effect of duration of symptoms on length of survival following therapy.

vertible, evidence does not show that a greater survival may be expected following x-ray therapy with a shorter time lag between onset of symptoms and diagnosis. Certainly, the important factor is to initiate therapy before secondary spread has occurred. Chart I, a "scattergram," shows the lack of relationship between these two factors. If any correlation existed, cases should fall in a broad zone extending from the upper left to the lower right corner of the graph. A glance is sufficient to establish the fact that the great majority of cases lie outside this zone.

Survival According to Histologic Type: Patients with undifferentiated carcinoma showed the shortest survival following therapy—5.5 months. Those with adenocarcinomas had the longest average survival—8 months. Squamous-cell carcinoma occupied an intermediate position, with an average survival of 7.1 months. The high average survival rate in the adenocarcinoma group is probably due to 2 patients who lived 20 and 24 months after therapy. Without these 2 cases the group as a whole shows a survival of only 3.3 months. This accords with the generally accepted belief that squamous-cell carcinoma gives the longest survivals.

It may be seen, by referring to Chart II, that 22 patients survived more than 12 months after therapy. Of these, 15 had squamous lesions, 2 undifferentiated carcinomas and 2 adenocarcinomas. Two cases were classified only as "malignant tumors" and 1 as "bronchogenic carcinoma, type indeterminate."

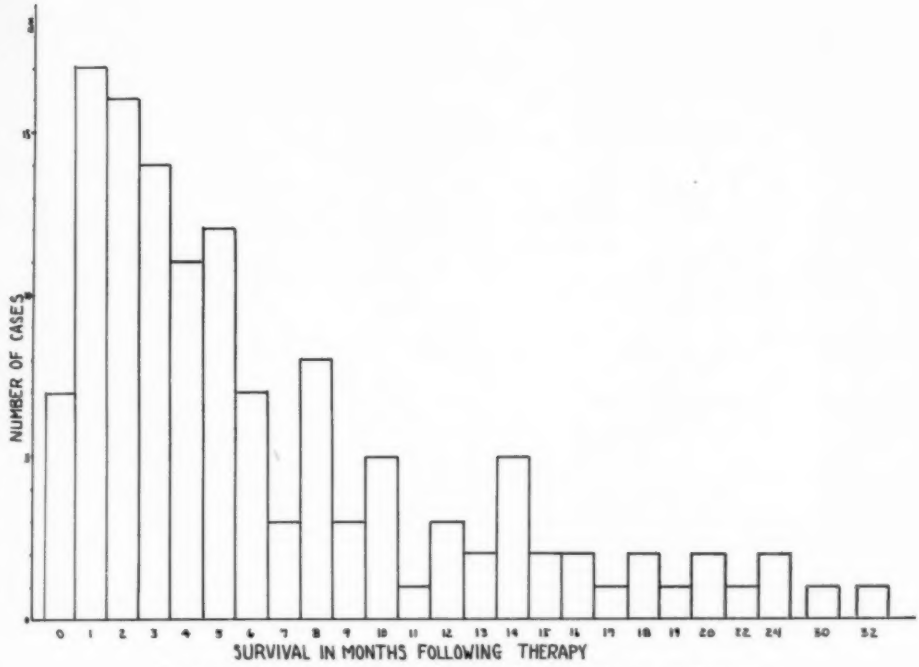

Chart II: Distribution of length of survival following x-ray therapy.

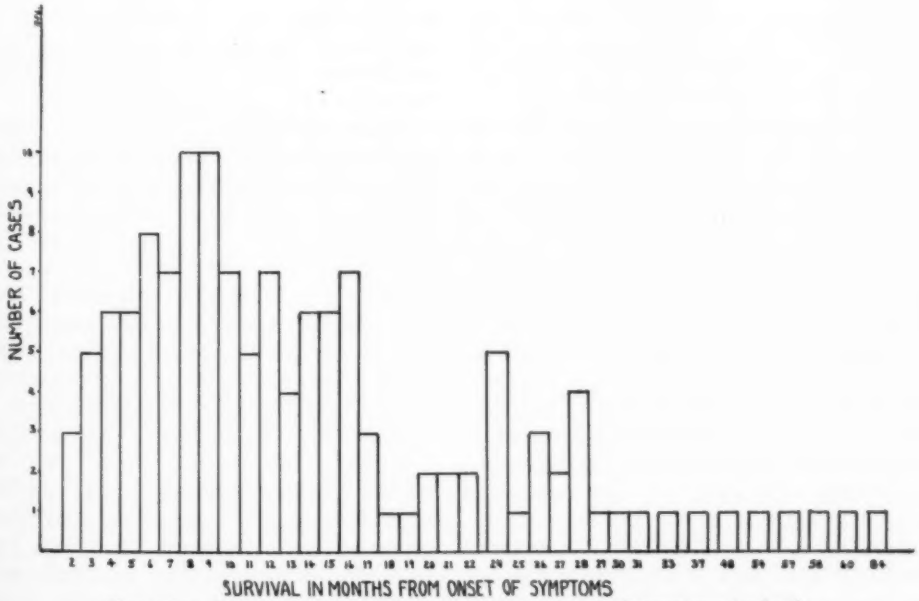

Chart III: Distribution of length of survival from onset of symptoms to death.

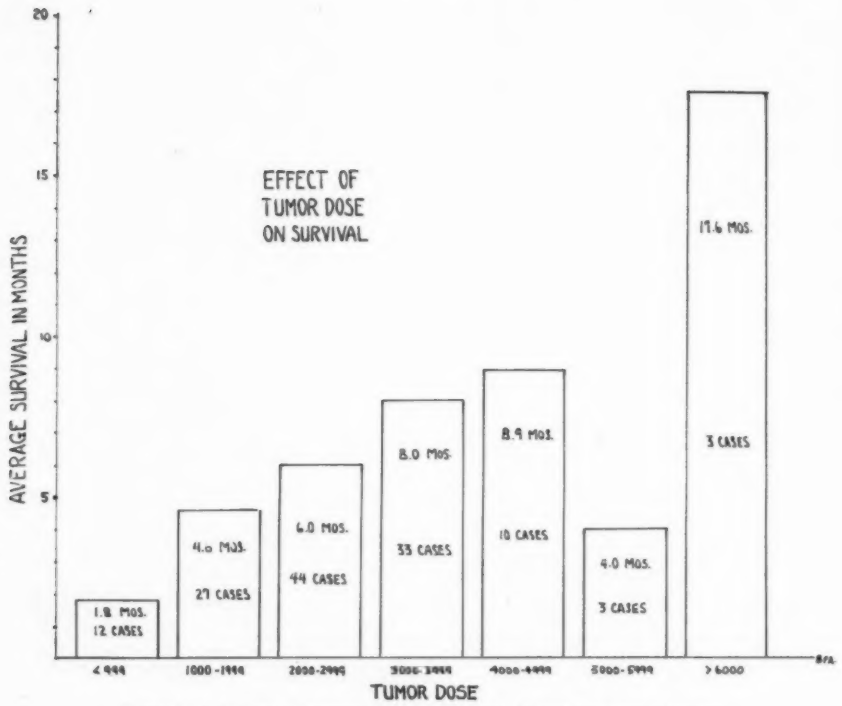

Chart IV: Effect of tumor dose on survival following x-ray therapy.

Chart III depicts the total survival in months, from the onset of disease to death. Twenty-one patients had a total duration of disease of over twenty-four months; of these, 14 had squamous-cell lesions.

Survival According to Sex: The average survival for the group as a whole from onset of disease to death was 14.3 months, while for females alone the average was 24 months. Possibly the greater frequency of adenocarcinoma in females, particularly that variety developing from a pre-existing benign adenoma with its accompanying long history, is at least in part responsible for this discrepancy. The difference is not nearly so marked when survival after therapy is considered. The group as a whole averaged 6.6 months while female patients lived for an average of 7.6 months.

Survival According to Tumor Dose: If the lengths of survival following therapy are compared with the tumor dose given, no definite relationship is apparent at a casual glance. These statistics were first plotted on a graph on an individual basis, and the haphazard and random scattering of the points showed no apparent correlation.

The results were next analyzed in groups, as shown in Chart IV. Seven groups of tumor doses were established, and it would seem that some correlation appears between longevity and dose. Only in the group receiving a depth dose of from 5,000 to 6,000 r is the trend disturbed. There were, however, only 3 cases in this group, so that the result is probably not significant. But with tumor doses varying upward to 5,000 r, a definite progressive increase in life expectancy seems to be found. This may be more apparent than real, however, for it is reiterated that patients receiving higher doses were generally in an earlier stage of the disease, and always in better condition to withstand the rigors of an intensive course of therapy.

In order to determine the significance

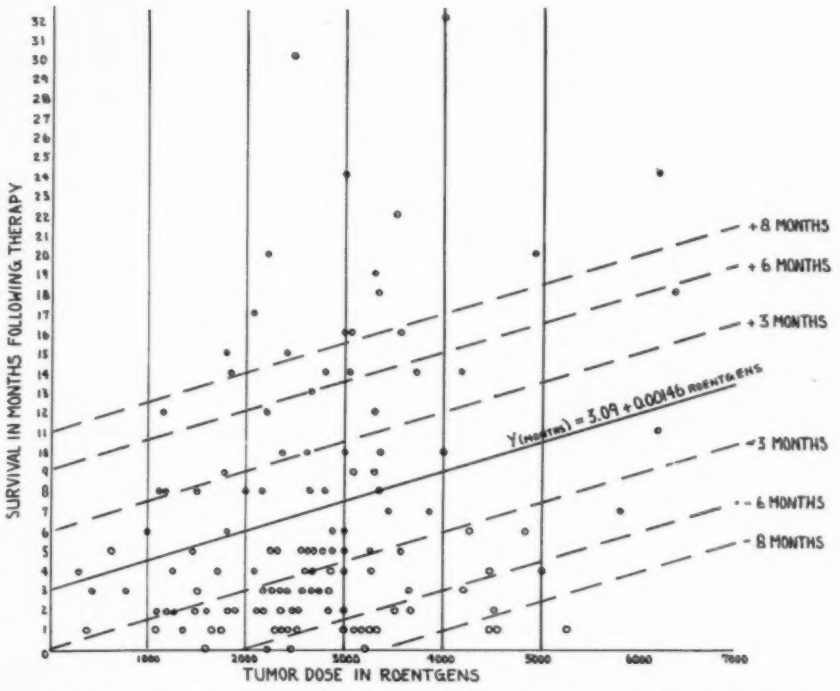

Chart V: Effect of tumor dose on survival following x-ray therapy (individual cases).

of the results shown in Chart IV, the figures were submitted to statistical analysis. First, a "scattergram" (Chart V) was constructed in which each case was plotted as a single point, dependent upon the tumor dose in roentgens and the number of months of survival following x-ray therapy. Excluded from this summary were patients dying before the completion of therapy (except for those receiving a tumor dose of over 1,500 r) and those who were transferred elsewhere for completion of treatment. This left 125 cases suitable for analysis.

A linear function was established by the method of least squares from these points. This bore the equation:

$$Y_{(\text{months survival})} = 3.09 + 0.00146 \text{ roentgens}$$

This line represents an average of the relationships between survival and tumor dose, and indicates that an untreated patient would be expected to survive about three months.

Various hypotheses were then presumed and tested for goodness of fit. Each case was placed in one of six groups depending on average tumor dose within the group. These averages were 500 r, 1,500 r, 2,500 r, 3,500 r, 4,500 r, and 5,500 r and over.

The first hypothesis tested was that assuming that there was *no* radiation effect, and that the distribution was pure chance, cases would *not* survive according to the equation, plus or minus three months. This gave a chi-squared value of 72.4 with a probability of less than 1/1,000,000, indicating the line is *not* associated with chance.

Various other hypotheses were then tested assuming that there *was* a definite radiation effect. These were tested for goodness of fit for varying percentages of predictability, and with errors of prediction ranging from plus or minus three months to plus or minus eight months. The probabilities have been summarized in Table I.

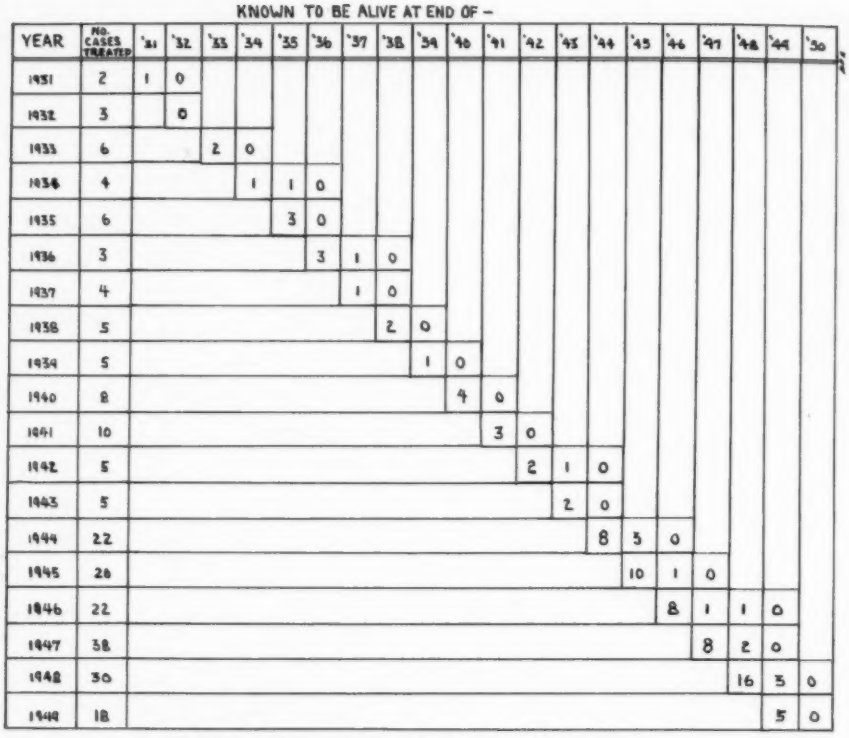

Chart VI: Annual summary of results of x-ray therapy.

TABLE I: PROBABILITY OF ASSOCIATION DERIVED FROM CHI-SQUARED TEST FOR GOODNESS OF FIT

Percentage of Success in Prediction	Plus or Minus 3 Months	Plus or Minus 6 Months	Plus or Minus 8 Months
100%	Less than 1/1,000,000 (no association)	0.52 (chance association)	0.48 (chance association)
80%	0.001 (no association)	0.86 (chance association)	0.68 (chance association)
70%		0.90 (slight positive association)	0.81 (chance association)
60%		0.65 (chance association)	0.31 (chance association)
50%	0.09 (chance association)		
20%	Less than 1/1,000,000 (no association)		

The best prediction that can be made from our results is that in 70 per cent of cases, with a 90 per cent probability of accuracy (*or* a 10 per cent probability of failure), those receiving a certain tumor dose will survive according to the above linear function, plus or minus six months. The 90 per cent probability of accuracy indicates a real trend, but is not statistically satisfactory. Indeed, it is obvious that such a prediction is of no value, since the six-month error in either direction would include the great majority of cases treated.

The equation may also be expressed:

$$Roentgens = 715\ Y_{(months)} - 2140$$

In other words, the number of roentgens required for a given survival can be calculated theoretically, but again in only 70 per cent of the cases, with a 10 per cent probability of error, and allowing six months in either direction.

In summary, there is almost a statistical denial that survival is definitely increased with increasing tumor dose. At least from a clinical point of view, these results lead to the conclusion that little clinical benefit in terms of increasing survival will result from increasing tumor doses.

Chart VI summarizes in tabular fashion the generally ungratifying results of x-ray therapy for bronchogenic carcinoma. It will be noted that the number of surviving patients treated in any one year drops off rapidly. A glance at the chart will show that no patient treated prior to Jan. 1, 1950, is still alive, the last surviving patient having died in November 1950.

CONCLUSION

A statistical analysis of 125 cases of bronchogenic carcinoma treated by x-ray therapy fails to reveal any definite trend to increased longevity with increasing tumor dose. Other factors, such as the age of the patient at onset of disease, duration of symptoms prior to diagnosis, and sex are also of no apparent prognostic importance. There is some difference in survival following therapy for different histologic types, the longest survivals being expected with squamous-cell carcinoma.

NOTE: The author is deeply indebted to Dr. Robert H. Peckham, Research Professor of Optical Physiology at the Temple University Medical School and Hospital, for having carried out the statistical analysis of these data.

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SUMARIO

Resultados de la Radioterapia en el Carcinoma Bronquiógeno

Un análisis estadístico de 125 casos de carcinoma bronquiógeno tratados con los rayos X no revela ninguna tendencia bien definida hacia un aumento de la longevidad al aumentarse la dosis tumor. Otros factores, tales como la edad del sujeto al iniciarse la enfermedad, la duración de los síntomas antes del diagnóstico y el sexo, tampoco revisten aparentemente importancia pronóstica. Hay alguna diferencia en la sobrevivencia consecutiva a la terapéutica en diversas formas histológicas, esperándose las sobrevivencias más largas en el carcinoma escamocelular.

Experience with Grid Therapy[1]

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New York, N. Y.

AMONG THE RECENT technics in the treatment of cancer is the use of a perforated grid in radiation therapy. This paper is a report of 10 cases treated by this method.

Köhler (1) was the first to report on the use of a grid in x-ray therapy in 1909. The literature contains no other reference to this form of treatment until 1933, when Liberson (2), unaware of the previous report, developed the same idea. He found that the skin could tolerate larger doses and would recover more quickly when the radiation was delivered through a grid. Haring (3), Grynkraut (4), Goldfeder (5), Jolles (6), and Jolles and Koller (7) have all written on some phase of this form of therapy.

Two years ago Marks (8) demonstrated his results with massive doses through a grid and aroused interest in this new procedure. He administered as much as 1,200 r daily for twenty treatments, using a grid which was placed in exactly the same position for each treatment. Although the ports were large, the skin usually healed without complications and in some instances the underlying radioresistant and inoperable cancer disappeared.

METHOD

Use of the grid technic at the Beth Israel Hospital was begun in the latter half of 1950, only histologically proved single-focus inoperable cancer known to be radioresistant being selected for treatment. Ten cases were so treated. Four of the patients had been irradiated previously. In one, treatment was begun with the conventional technic, but because of lack of response a change was made to the grid method. The others had received no previous irradiation.

The grid employed was made of lead rubber of 1.3 mm. Pb equivalent. It had round holes, 1 cm. in diameter, with 1.4 cm. between centers, permitting 40 per cent of the direct beam to pass. This type of grid was selected because the skin and depth dose measurements were made available to us by Lillian E. Jacobson, physicist at Montefiore Hospital.

For successive treatments in any given case the grid was placed in exactly the same position, and to facilitate replacement its outer borders were mapped on the skin. In addition, several holes at the periphery and center of the field were also marked. Of the dyes employed for this purpose, Castellani paint was found to be the most satisfactory, since it was visible for a longer time. As a rule, after one or two treatments an erythema of the skin appeared corresponding to the position of the holes, simplifying replacement of the grid.

A daily dose of between 500 and 1,200 r in air was given. An attempt was made to deliver 5,000 r to the level of the tumor beneath the covered portion of the grid. Although it was felt that this probably represented the optimum dose, in many instances the treatments were discontinued before this dose was reached because of the severe skin reaction. The height of reaction was usually observed in the fifth or sixth week of treatment. It would therefore seem desirable not to prolong treatments beyond thirty days.

The initial response corroborated the experience of Marks. The tumors either shrank considerably or completely disappeared.

Brief histories of the 10 patients follow. Table I contains a summary of the essential treatment data.

[1] From the Radiotherapy Department, Beth Israel Hospital, New York, N. Y. Accepted for publication in November 1951.

TABLE 1: ESSENTIAL TREATMENT DATA

Case	Diagnosis	Dates	Days	Port	Air Dose in Roentgens		Skin Dose in Roentgens		Tumor Dose in Roentgens			Previous Conventional Therapy
					Daily	Total	Open	Covered	Open	Covered	Average	
I J. G.	Epidermoid carcinoma of bladder	1–8–51 2–7–51	30	A. pelvis 10 × 10 cm.	820	23,700	27,200	5,100	8,850	4,750	5,700	None
II M. G.	Epidermoid carcinoma of bladder	9–19–50 10–13–50	30	A. pelvis 10 × 10 cm.	500	12,250	12,740	2,260	4,150	2,000	2,850	3,500 r in 1946 2,500 r in 1950
III R. D.	Epidermoid carcinoma of lung (RUL)	1–17–51 2–16–51	30	A. chest 10 × 10 cm. P. chest 10 × 10 cm.	1,075 1,075	11,825 11,825	12,400 12,400	2,370 2,370	5,800	3,300	5,000	None
IV P. M.	Anaplastic carcinoma of lung (RUL)	4–9–51 5–19–51	41	A. chest 10 × 10 cm. P. chest 10 × 10 cm.	1,075 1,075	11,825 11,825	12,400 12,400	2,370 2,370	5,800	3,300	5,000	None
V M. M.	Adenocarcinoma of lung (LUL)	6–12–51 7–19–51	38	A. chest 10 × 15 cm. P. chest 10 × 15 cm.	1,000 1,000	12,000 12,000	13,800 13,800	2,580 2,580	6,200	3,600	4,800	None
VI D. F.	Epidermoid carcinoma of lung (RUL)	9–18–50 10–28–50	32	Right neck 10 × 10 cm.	500	11,500	12,900	2,130	8,600	3,450	5,500	None
VII E. N.	Brain tumor: Glioblastoma	4–17–51 5–5–51	19	Right lat. skull 10 × 10 cm.	1,075	18,275	20,640	3,380	10,000	4,000	6,400	1,800 r in 1950
VIII H. M.	Brain metastases from cancer of breast	6–8–51 7–12–51	35	Left lat. skull 10 × 10 cm.	1,000	20,000	22,600	3,700	11,000	4,400	7,000	2,650 r in 1948 950 r in 1951
IX A. M.	Epidermoid carcinoma of esophagus	12–11–50 1–8–51	28	A. med. 15 × 6 cm. P. med. 15 × 6 cm.	1,075 1,075	12,750 11,825	14,500 13,400	2,350 2,200	5,750	3,450	5,500	None
X R. S.	Epidermoid carcinoma of rt. tonsil	11–21–50 12–8–50	17	R. submax. 10 × 10 cm.	1,200	15,600	17,600	2,880	8,600	3,450	6,250	2,000 r in 1950

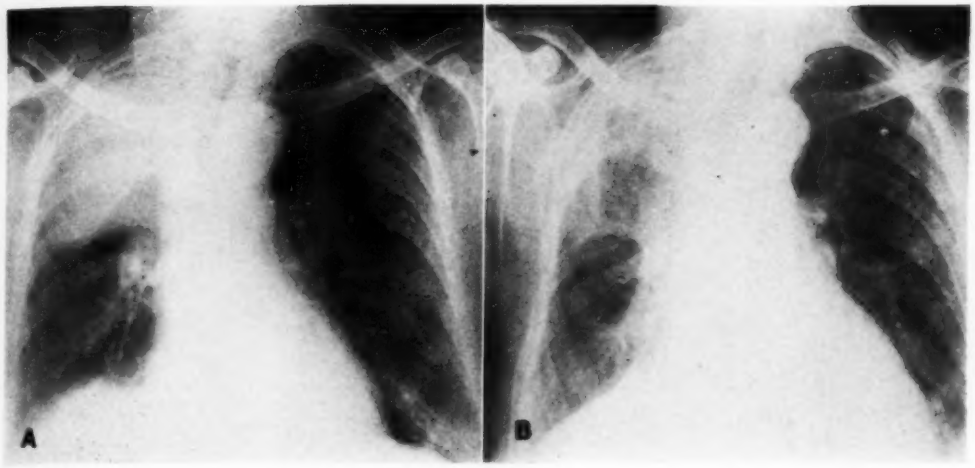

Fig. 1. Case III. A. Inoperable carcinoma of the right upper lobe. B. Partial re-aeration of right upper lobe after therapy.

CASE REPORTS

CASE I: *Carcinoma of the Bladder.* J. G. was a 70-year-old man with an extensive papillary carcinoma of the bladder, extending halfway up the left lateral wall, across the floor to the posterior wall, and along one third of the right lateral wall.

Since the patient's age and poor general health would not permit a complete cystectomy, the only surgical procedure to offer a possible cure, and since conventional x-ray or radium therapy for cancer of the bladder is frequently unsatisfactory, it was decided to use the grid. A daily dose of 820 r in air was given for a total of 23,740 r. The skin dose under the grid openings was 27,200 r and under the covered section 5,100 r. The skin reaction was rather severe but healing progressed without complications. The height of the reaction was reached about the last treatment day and persisted for two weeks. The tumor dose D_s under the openings was 8,850 r and under the covered parts was 4,750 r.

The symptoms subsided. Cystoscopy about four months after therapy showed no definite evidence of tumor. A cystogram, about six months after treatment, showed a bladder of normal capacity and regular contour, but three months later the patient began complaining of severe pain in the suprapubic region, where there was marked induration of the abdominal wall corresponding to the field of irradiation. Cystoscopic examination at this time revealed a tumor in the region of the neck of the bladder. The material removed for biopsy was insufficient for diagnosis.

The initial response here was encouraging. The subsequent course raises some doubt as to the efficacy of the method.

CASE II: *Cancer of the Bladder.* M. G., a 50-year-old man, had advanced cancer of the bladder diagnosed five years before, at which time the tumor was fulgurated and implanted with radon seeds. A year later he received a course of x-ray treatment, 3,500 r to two anterior pelvic ports, and four years later he was given 2,500 r to each of the same two ports. Six months after the last course of treatment, he complained of severe dysuria and hematuria, and cystoscopic examination showed persistence of the tumor.

Since the previous irradiation did not control the disease and additional treatment with the conventional method seemed useless, it was decided to treat this patient with the grid. Because the skin had already received 6,000 r, some difficulty in its healing was anticipated. The daily dose was reduced to 500 r. On the twenty-fourth day, the erythema was marked and it was felt that the maximum skin tolerance had been reached. Although the total dose was only 12,250 r in air, therapy was discontinued. The skin dose under the grid openings totaled 12,740 r and under the covered portion 2,260 r. The reaction was very severe and the skin failed to heal completely. A necrotic area in the left groin persisted and was excruciatingly painful. The tumor dose D_s under the openings was 4,150 r and under the covered areas 2,000 r. Hematuria was controlled, but the tumor was still present on cystoscopic examination.

About four months after therapy, the necrotic area extended into the bladder and was constantly bathed in urine. To divert the urinary stream, a ureterosigmoidostomy was performed. Paralytic ileus and other complications followed, and the patient died several days postoperatively. At autopsy, viable tumor was found to be still present in the treated area.

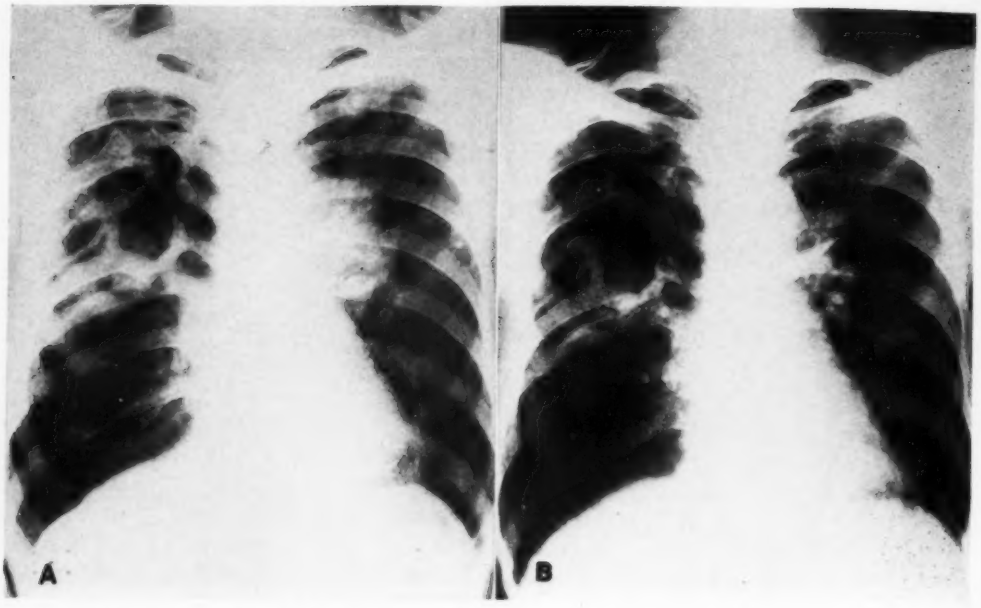

Fig. 2. Case IV. A. Metastatic mass in left hilar region. B. Disappearance of left hilar mass after therapy.

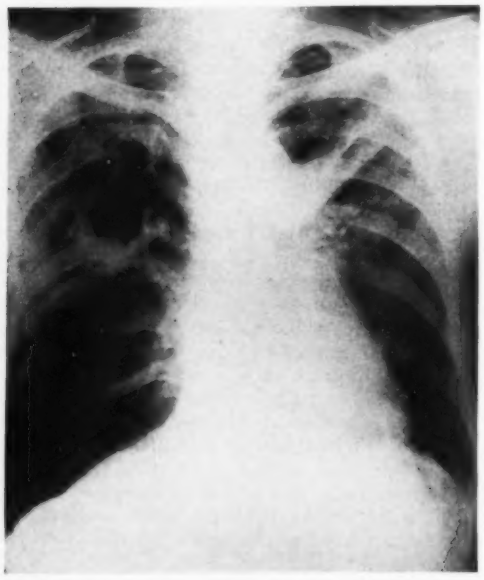

Fig. 3. Case IV. Irradiation pneumonitis of left upper lobe three months after therapy.

The previous heavy irradiation made this case a poor selection for testing the efficacy of grid therapy. It serves, however, to emphasize the danger of superimposition of grid therapy on a previously irradiated field.

In the cases of cancer of the lung which follow, it was decided to see what grid therapy could offer, since conventional therapy produces satisfactory palliation in only a limited number of patients.

CASE III: *Epidermoid Carcinoma of the Lung.* R. D., a 60-year-old woman, had a thoracotomy for an inoperable epidermoid carcinoma of the right upper lobe. When referred for treatment, she complained of pain in the chest, cough, hemoptysis, poor appetite, and loss of weight.

A daily dose of 1,075 r in air was given to an anterior chest port, alternated with a posterior chest port, for a total of 11,825 r to each port. Three months after treatment the patient was asymptomatic, had gained weight, and had a sense of well-being. A roentgenogram of the chest at this time showed partial re-aeration of the right upper lobe (Fig. 1). The tumor dose under the grid openings was 5,800 r; under the covered section it totaled 3,300 r.

Four months later, the patient began complaining of cough, and examination of the chest disclosed a pneumonitis of the right lower lobe. The symptoms persisted for about two weeks. One month later a chest film disclosed resolution of the pneumonic process. Nine months after therapy, this patient is asymptomatic.

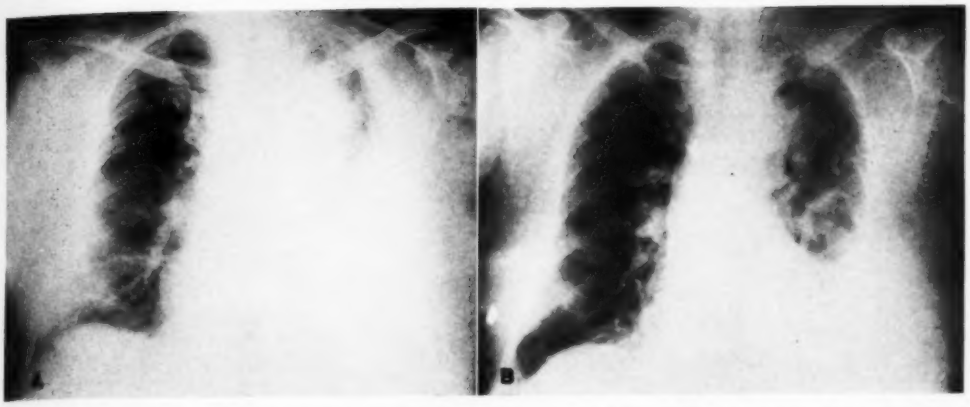

Fig. 4. Case V. A. Inoperable carcinoma of left upper lobe. B. Decrease in size of left upper lobe mass and re-aeration of left lung after therapy.

This can be considered excellent palliation for such an advanced case.

CASE IV: *Carcinoma of the Lung.* In January 1950, a right lower lobe lobectomy was performed on a 60-year-old man (P.M.) for anaplastic carcinoma of the lung. Lymph nodes removed at operation showed no metastases.

When referred for irradiation in April 1951, the patient was weak and emaciated. He complained of cough, hemoptysis, and pain in the chest. X-ray examination revealed a mass in the left hilar region (Fig. 2A). A course of grid therapy was instituted and 11,825 r was given to an anterior chest port and the same amount to a posterior chest port. After treatment, symptoms disappeared. There was a gain in weight and the patient felt well. X-ray examination of the chest revealed disappearance of the hilar mass (Fig. 2B).

Four months after radiation therapy the cough had returned and re-examination of the chest revealed a pneumonitis of the left lung (Fig. 3). Seven months after therapy, the patient had no pulmonary symptoms. He complained, however, of general weakness, which may be an indication of distant metastasis as yet uncovered.

Symptomatic and objective improvement in this patient should be considered a good result.

CASE V: *Carcinoma of the Lung.* M. M., a man fifty-eight years old, underwent an exploratory thoracotomy on May 28, 1951, for an inoperable carcinoma of the left upper lobe which invaded the wall of the aorta. Biopsy showed anaplastic adenocarcinoma. The patient received 12,000 r to each of two ports—left anterior and posterior chest. The tumor dose under the openings was 6,200 r, under the covered areas 3,600 r, an average dose of 4,800 r.

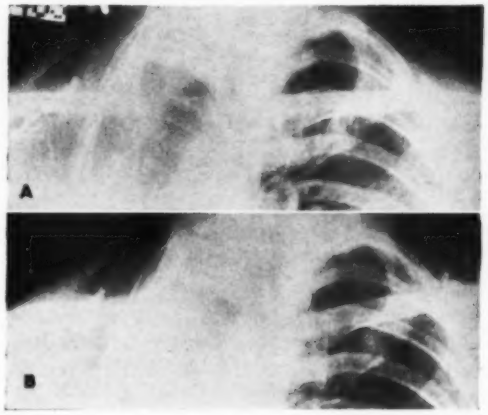

Fig. 5. Case VI. A. Mass of metastatic nodes in right supraclavicular region. B. Disappearance of supraclavicular mass after therapy.

When last seen, five months after treatment, the patient showed marked symptomatic improvement. He had gained weight. Cough and hemoptysis had subsided. A large metastatic mass involving the chest wall along the lower portion of the operative scar caused much discomfort. X-ray examination revealed a considerable decrease in the size of the intrathoracic tumor, with re-aeration of the left lung field (Fig. 4).

The relief of pulmonary symptoms for even this short period may be considered a satisfactory response.

CASE VI: *Carcinoma of the Lung.* D. F., a 60-year-old woman, had a pneumonectomy for epidermoid carcinoma of the right upper lobe. Twelve months later a mass of metastatic nodes appeared in the right supraclavicular region (Fig. 5A). Grid

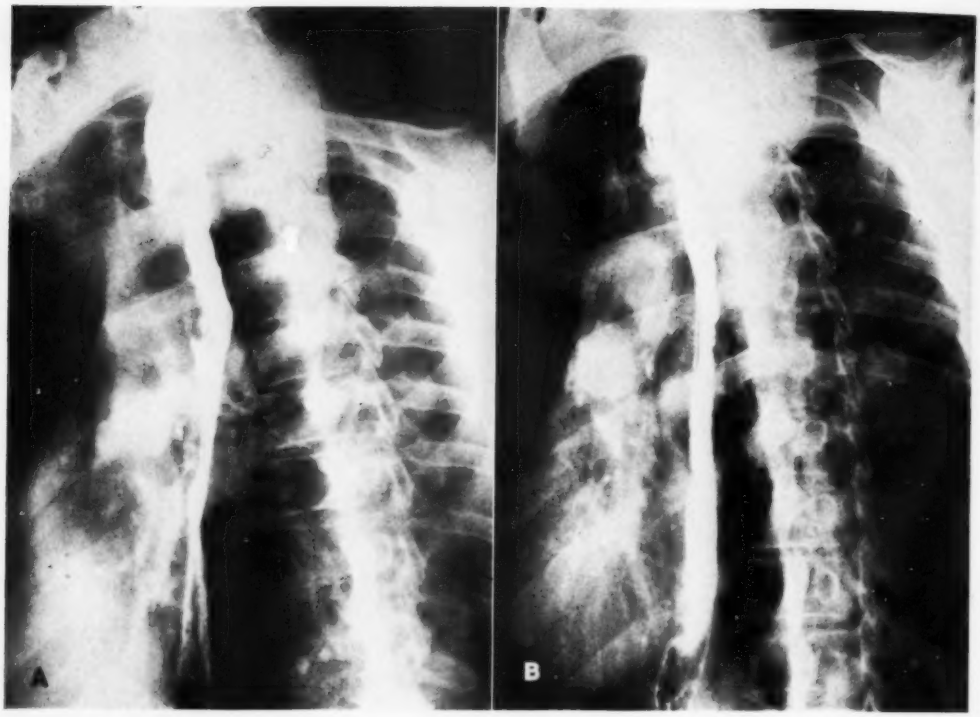

Fig. 6. Case IX. A. Marked obstruction of the esophagus due to a polypoid mass at the junction of its upper and middle third. B. After therapy. No tumor demonstrable in the esophagus. Barium passed freely into the stomach.

therapy was administered to this area, a daily dose of 500 r in air being given. On the thirty-second day treatment was discontinued because of the severe skin reaction. The total air dose was 11,500 r. The skin healed perfectly, showing only a trace of the grid pattern. The mass disappeared, as seen in Fig. 5B. There was no evidence of disease a year after treatment. For details of dose see Table I.

Metastatic nodes in the neck are usually radioresistant. It would have been almost impossible to deliver a cancericidal dose to this mass with conventional methods, but grid therapy yielded an excellent result.

CASE VII: *Brain Tumor (Glioblastoma Multiforme).* E. N., a 50-year-old man, had a tumor occupying the right precentral convolutions partially removed. He had received a skin dose of 1,800 r with conventional irradiation, following which he improved temporarily and returned to work. Symptoms recurred three months later and progressed so rapidly that within two to three weeks he became bedridden. Past experience suggested that little if any palliation would be achieved by a return to conventional therapy, and treatment was given with the grid, 18,275 r being delivered to the right lateral skull. The patient improved immediately following treatment, but one month later symptoms recurred and he again became bedridden. At the decompression site and directly in the treated field was a large mass. The estimated tumor dose beneath the grid openings was 9,900 r, beneath the covered areas 3,600 r, an average of 6,300 r. Apparently even this large dose was not sufficient to control the disease. Death occurred five months after treatment.

CASE VIII: *Brain Metastases from Carcinoma of the Breast.* H. M., a 49-year-old woman, had been well for six years after a right radical mastectomy. In 1948, symptoms developed suggestive of brain metastases and she was given a course of x-ray therapy to the head, with symptomatic improvement. The tumor dose was 3,900 r. Three years later the symptoms recurred and another course of x-ray treatments was begun. After a tumor dose of 1,800 r was reached, there was indication of a marked increase in intracranial pressure and a subtemporal decompression was performed. Biopsy of a tumor in the left temporal lobe confirmed the diagnosis of metastatic carcinoma.

Because of marked progression of symptoms five months after operation and lack of response to the last course of treatment, grid therapy was administered: 20,000 r was given through a field to which a skin dose of 3,600 r had previously been delivered. The tumor dose under the openings was 11,000 r, under the covered portion 4,400 r, an average dose of 7,000 r. At the time of this report, five months after treatment, almost all symptoms have disappeared. There is no evidence that normal brain tissues have been damaged. The palliation obtained was most satisfactory.

CASE IX: *Carcinoma of the Esophagus.* A. M., a 55-year-old man with a history of dysphagia of several months duration, was found on esophagoscopy to have an ulcerated lesion 20 cm. from the incisor teeth. Biopsy revealed an anaplastic epidermoid carcinoma. Three weeks later a 2-cm. node removed from the right supraclavicular fossa disclosed metastases. The case was considered inoperable.

Since treatment of carcinoma of the esophagus by conventional methods has shown poor results, a trial of grid therapy was undertaken. A daily dose of 1,075 r was given to an anterior mediastinal port for a total of 12,750 r. A posterior mediastinal port received 11,825 r. The patient became asymptomatic, gained weight, and returned to work. X-ray examination of the esophagus showed complete disappearance of the lesion (Fig. 6). Six months later, parenchymal pulmonary metastases were present, but there were no symptoms referable to the esophagus.

In spite of the pulmonary metastases, grid therapy was successful in this case, since the primary lesion was apparently controlled.

CASE X: *Carcinoma of the Anterior Fauces of the Right Tonsil.* R. S., a 48-year-old man with an epidermoid carcinoma of the anterior fauces of the right tonsil, had a fixed 6-cm. node in the right submaxillary region. Conventional irradiation therapy was administered to this area but was discontinued after 2,000 r because of lack of noticeable response. Grid therapy was then given, 1,200 r in air daily for a total of 15,600 r to the same right submaxillary area. Although the skin reaction was severe, healing occurred in about two weeks. There were no complications. The primary tumor and metastatic node disappeared. The patient remained asymptomatic for six months. A paraplegia then developed, believed to be due to irradiation cord injury at the level of the fifth and sixth cervical vertebrae. Ten months after treatment the patient died. Autopsy confirmed the clinical diagnosis of irradiation necrosis of the cervical cord. Tissue removed from the right submaxillary and right tonsillar regions contained no tumor.

Irradiation utilizing the grid technic destroyed the primary tumor and metastasis, but the injury to the cord nullified a good result. This illustrates the importance of avoiding possible damage to the cord while delivering the necessary dose to the tumor.

DISCUSSION

Grid therapy is a radical treatment to be used in advanced cancer when the usual methods fail. In this group are included a number of neoplasms, such as cancer of the lung, esophagus, bladder, metastatic nodes, and others usually considered resistant to conventional irradiation technics. By means of supervoltage therapy a larger dose can be delivered to deep lesions and improved results have been reported. A somewhat similar effect of increased depth dose is obtained with rotational therapy. The grid technic offers still another and simpler method of accomplishing the same result with standard high-voltage apparatus.

With the grid, a column of tissue beneath the openings is irradiated by the direct beam. Since the skin dose is very high, a dose of 5,000 or 6,000 r is readily obtained at a depth of 10 or 11 cm. The tissues under the covered part of the grid are uniformly irradiated to a depth of 7 or 8 cm. by a dose approximately one-fifth of the air dose. For tumors situated within this volume of tissue, a minimum dose approximating the cancericidal dose can be administered through a single port. For tumors situated at greater depths, such as cancer of the lung or esophagus, two opposing ports can be utilized. Cross-firing as employed in conventional therapy is unnecessary and may be dangerous because of overlapping of maximal doses.

In grid therapy, there is a maximum dose under the openings and a minimum dose under the covered areas. Which one of these values should be considered in planning therapy has not as yet been ascertained. In Case I, carcinoma of the bladder, the tumor dose under the openings was 8,850 r and under the covered

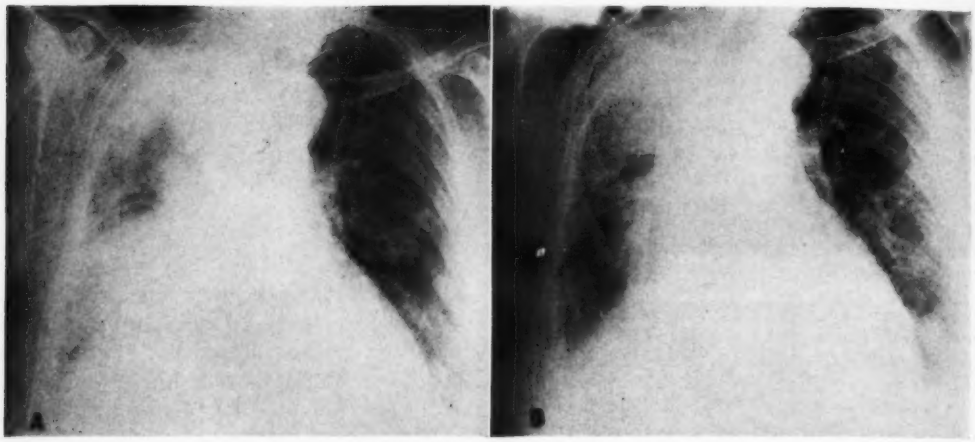

Fig. 7. Case III. A. Irradiation pneumonitis of right lower lobe four months after therapy. B. Resolution of postirradiation pneumonitis one month later.

parts 4,750 r. In Case IV, metastatic node from carcinoma of the lung, the corresponding tumor doses were 8,600 r and 3,050 r. The maximal dose in these cases is appreciably larger and the mimimal dose appreciably smaller than the accepted cancericidal dose for epidermoid carcinoma. However, the average dose in each instance was 5,500 r, approximately the necessary tumor dose with conventional therapy. It may be that it is preferable to use the average dose as the goal in planning therapy.

Because of the high dosage used in grid therapy, serious complications are more frequently encountered than in conventional therapy. One must be aware of them and avoid them where possible.

In this series, although large doses were employed, the skin healed promptly in nearly every instance. Patients observed almost one year after treatment showed the usual changes found following conventional therapy, such as atrophy, induration, and telangiectasia. The grid pattern was distinct. The skin corresponding to the openings was blanched due to loss of pigment.

Difficulties in skin healing may arise when treatment is given to previously irradiated fields. In Case II, carcinoma of the bladder, treatments were given over a field previously heavily irradiated and, although the daily and total doses were reduced to one-half, the skin did not heal and a permanent necrosis resulted.

Serious intestinal injuries may result from irradiation over the abdomen, although no such injuries were observed in treatments to the bladder. Pneumonitis nearly always follows treatment over the lungs, the signs and symptoms usually appearing about two or three months after irradiation. One should not mistake this complication for progression of the disease. Fig. 7A shows the pneumonitis which developed in Case III three months after treatment and Fig. 7B discloses clearing of the process one month later. Spinal cord injury due to treatment is an extremely serious complication. Attention has been called to this hazard of radiation in several publications (9, 10, 11) and in a recent editorial in the *Journal of the American Medical Association* (12). Case X received treatment for carcinoma of the anterior fauces of the right tonsil. The lower corner of the treated field was directly over the cord at the level of the fifth and sixth cervical vertebrae. Six months later, paralysis developed due to irradiation cord injury, confirmed at autopsy.

Of the 10 patients with advanced inoperable cancer treated with the grid, 8 responded favorably, with subjective and objective improvement varying from three months to one year. In each case, the tumor disappeared or appreciably decreased in size. Only Case IX, a glioblastoma multiforme uninfluenced by treatment, can be considered a failure. Case II, carcinoma of the bladder, was incompletely treated and should not be included as a failure. Thus, in 8 of 9 patients a favorable response to this treatment was obtained.

Grid therapy has been employed in our hospital for a little over a year in a selected number of patients. This report is a tentative interim presentation, lacking the finality of more extensive application and the observation over a long period necessary for reliable evaluation.

SUMMARY

The results of irradiation through a grid in 10 cases are presented. The selection of cases for grid therapy is discussed, as are the method of applying the grid, the daily and total dosage, and some of the complications of treatment. The skin and tumor doses under the open and closed ports have been calculated and the skin reaction described.

Experience to date seems to indicate that grid therapy is an important contribution to radiotherapy technics. By this method, favorable therapeutic results were obtained in several patients with inoperable and extensive cancer. The full value of this method can be assessed only after a large number of observations extending over many years.

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SUMARIO

Aplicación Terapéutica de la Rejilla

Diez enfermos con cáncer inoperable muy avanzado fueron tratados con la irradiación administrada a través de una rejilla de caucho-plomo que dejaba pasar 40 por ciento del haz de radiación directa. Se administró una dosis diaria de 500 a 1200 r al aire con la intención de llevar 5,000 r al nivel del tumor debajo de la porción de la rejilla entre las aberturas, aunque en algunos hubo que discontinuar el tratamiento, debido a graves reacciones cutáneas, antes de alcanzar dicha dosis. Los casos comprendieron 2 carcinomas de la vejiga, 4 carcinomas pulmonares, un glioblastoma multiforme del cerebro, metástasis cerebrales de un

cáncer mamario, un carcinoma del esófago y un carcinoma de las fauces anteriores de la amígdala. En uno de los casos de tumor vesical no se terminó el tratamiento y el glioblastoma multiforme no respondió. En los otros 8 casos, el resultado fué considerado como favorable, pues se aliviaron los síntomas y hubo desaparición o disminución de tamaño de la lesión primaria, según se observó en un período de tiempo que varió de tres meses a un año.

Recálcase que sólo después de un gran número de observaciones que abarquen muchos años cabrá computar de cierto el valor de la técnica.

Adenoma of the Jejunum

A Case Report[1]

SAVA M. ROBERTS, M.D., LOUIS Y. PESKOE, M.D., and DAVID E. FADER, M.D.

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IN RECENT YEARS there have appeared in the literature many articles on benign tumors of the small intestine, both in the form of extensive treatises and case reports. Among these tumors, adenomas have received considerable attention, being one of the more common neoplasms of this portion of the gastro-intestinal tract. The jejunum, however, is said by Bockus (1) to be a rare site of adenoma. Of the 15 adenomas found in the small intestine by Raiford (12), only 1 was in the jejunum, an incidence of 6.6 per cent. Of Weber and Kirklin's series of 11 cases of adenoma (19), 2 (18.1 per cent) were in the jejunum. Among others reporting adenomas of the jejunum are Dundon (6), at the University Hospitals, Cleveland, who found 4 cases between 1933 and 1946; Botsford and Seibel (2), who reported 2 cases; Weinberger and Paltauf (20), who in a period of forty years at Lenox Hill Hospital (New York) collected 19 primary benign tumors of the small bowel of which 1 was an adenoma of the jejunum 2.5 cm. in diameter; Welch and McHardy (21), who reported 1 case; and Ravitch (13), who reported 2 cases of generalized polyposis with involvement of the jejunum. Williams and Williams (22), also reported 2 cases.

In view of the rather small number of jejunal adenomas in the literature, as evidenced by this short résumé, it is believed that the following case report may be of interest.

CASE REPORT

D. C., a 40-year-old white male, was admitted to the VA Hospital in December 1932, with a diagnosis of central nervous system syphilis (paresis). In 1947 vague gastro-intestinal symptoms developed and at that time laboratory tests were positive for blood in the feces. An upper gastro-intestinal series (Fig. 1) was reported as negative. The patient improved on symptomatic treatment, and after three months blood could no longer be demonstrated in the stools.

Fig. 1. Roentgenogram taken in 1947, showing the adenoma in the proximal jejunum just below the ligament of Treitz, and lateral to the greater curvature of the stomach.

In August 1949 there was a recurrence of abdominal pain and indigestion. A blood count at this time showed 4,500,000 red cells. An upper gastrointesti-

[1] From the Departments of Roentgenology and Medicine, VA Hospital, Augusta, Ga. Accepted for publication in November 1951.

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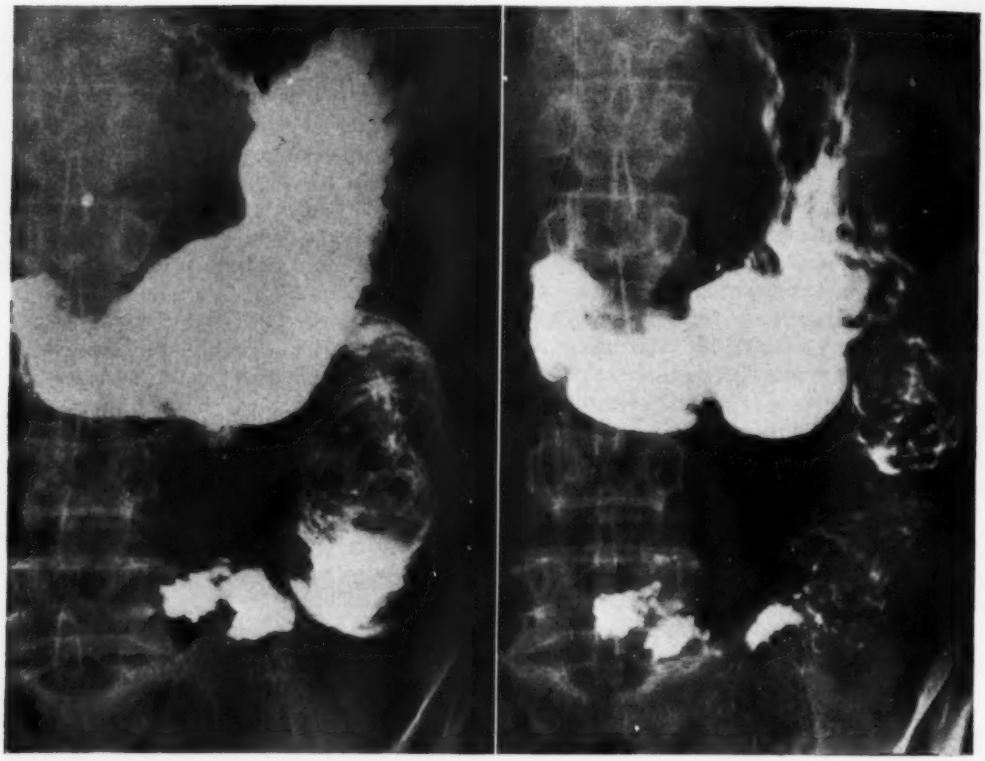

Fig. 2. Roentgenogram obtained Sept. 1, 1949, showing dilated portion of the proximal jejunum with prominent plicae circulares and effacement of the normal feathery mucosal pattern.

Fig. 3. A small bowel study made in December 1949, showing the lobulated cauliflower mass with barium in its depressions, situated within the proximal jejunum.

nal series (Fig. 2) on Sept. 1 was reported (S.M.R.) as showing a large ulcer crater along the lesser curvature side of the stomach measuring 1.5 × 1.0 cm., but with no Carman's sign to suggest malignancy. The duodenal bulb was normal. A loop of jejunum, just distal to the ligament of Treitz, about 8 cm. in length, was considerably dilated, measuring about 5 cm. in width, as compared to the remainder of the small intestine, which at no point exceeded 3 cm. The mucosal pattern in the dilated portion of the jejunum was considerably disrupted and irregular, with loss of normal feathery markings. Further studies were recommended.

The patient was placed on a routine ulcer regime and, because of his mental condition, was observed for a longer period of time than is usual without resorting to surgery, as serial gastro-intestinal studies showed a gradual decrease in the size of the ulcer, though it failed to disappear completely. A small bowel study in December 1949 (Fig. 3) again showed the dilated loop of the proximal jejunum previously described. A two-hour film demonstrated a flaky, whorl-like retention of barium in this area, which was well delineated, measuring 4 cm. in diameter. It was believed that this finding was of clinical significance.

The patient was kept under observation for about nine months, and in September 1950 he again complained of abdominal pain. A gastro-intestinal series now revealed an increase in size of the gastric ulcer and laboratory studies once more indicated blood in the feces. The red cell count showed a slight decrease, being 3,430,000.

A subtotal gastrectomy, with gastrojejunostomy and excision of a tumor from the small intestine, was performed on Oct. 10, 1950. The surgical report read, in part, as follows:

"A mass was felt about 2 inches distal to the ligament of Treitz. This mass seemed to move freely in the lumen. The jejunum was incised and the tumor was delivered through the wall of the jejunum. It was 5 cm. in diameter, somewhat lobulated, and attached, by a base 2.5 cm. in diameter, to the mucosa of the small bowel proximal to the area of incision in the jejunum. Clamps were placed across the base and the tumor was excised. The lumen of the jejunum at this area was quite large and there appeared to be no danger of stenosis."

The pathological reports follow:

"Chronic penetrating peptic ulcer, 0.5 cm. in diameter and 0.3 cm. in depth on the lesser curvature of the stomach in the prepyloric region. The section of stomach, including 1 cm. of duodenum, measures 7 cm. on the lesser and 15 cm. on the greater curvature. The ulcer has penetrated the muscularis and the base is composed of dense collagenous fibrous tissue which extends into the serosal adipose tissue. A number of tubular glands extend into the submucosa from the margin of the ulcer; at this site there is much submucosal fibrosis. The glands are dilated with secretion and many contain a cellular infiltrate. The epithelial morphology of the glands and their apparent continuity with mucosal glands suggest origin from healing of a previously more extensive ulceration and ensnaring of regenerated glands.

"Detached polypoid adenoma of the duodenum with cauliflower lobulations, the stalk being 1 cm. long and 0.8 cm. in diameter. The adenoma is composed of an intricate pattern of straight and branching glands which are lined with columnar mucus-secreting epithelium, well differentiated, with only a slight degree of anaplasia (Fig. 5). The stalk is covered with normal duodenal mucosal epithelium; an occasional nest of Brunner's glands is present. There is an inflammatory cell infiltrate of the adenoma, and a few of the glands are distended with purulent exudate."

The patient died the day after operation, following severe hematemesis.

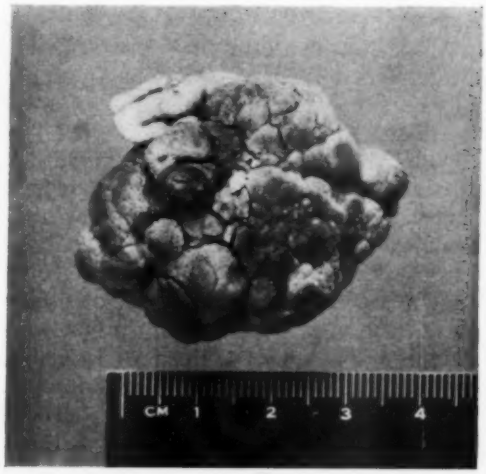

Fig. 4. Surgical specimen, showing the lobulated, cauliflower appearance of the tumor.

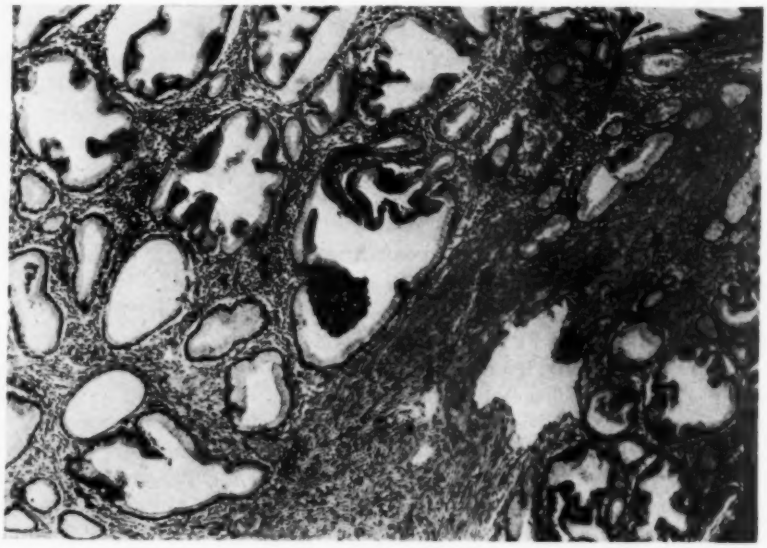

Fig. 5. Photomicrograph showing glandular structure with some degree of anaplasia, inflammatory cell infiltrate, and purulent exudate.

At autopsy a considerable amount of blood was found in the gastrointestinal tract, and it was felt that death was due to postoperative hemorrhage. There was no evidence of any other tumors in either the large or small bowel.

DISCUSSION

The infrequency of tumors of the small intestine is not too well understood.

Raiford, quoted by Williams and Williams (22), listed as causes of their low incidence the relative absence of stasis in the small intestine (except the terminal portion of the ileum, where the incidence is the highest) and the fact that there is little chance for arrested development and misplaced embryonal tissue in the small bowel because it develops chiefly during the last four months of fetal life.

Adenomas of the intestinal tract arise from hyperplasia of the intestinal epithelium. They may occur in any age group and in either sex. That a familial tendency exists has been pointed out by Huchtemann (10), Jüngling (11), and others (1, 7, 9, 22). Infection may be an etiologic factor (15). The tumors are more common in the distal small intestine. They may be single or multiple (3, 5, 17) and vary in size from a few millimeters to 5 and 6 cm. in diameter. They may become malignant, as brought out by Cassidy and Macchia (4), who reported a case of polyposis of the duodenum and jejunum with malignant change and intussusception.

Many of these tumors have been reported in the literature. Usually they have not been suspected until complications developed, such as obstruction, intussusception, or anemia, and most of them have been found either at surgery or postmortem.

The case reported above clearly indicates the importance of roentgen examinations in tumors of this portion of the gastrointestinal tract, a fact previously stressed by other investigators (8, 12, 16, 18). In the present instance the adenoma was associated with a benign gastric ulcer which failed to heal. There was no evidence of obstruction or intussusception, though there was a mild anemia in the later stages, due probably to the gastric ulcer rather than the adenoma, since no evidence of hemorrhage could be found in the tumor following its excision. The absence of intussusception and obstruction in spite of the large size of the tumor was probably due to its location below the ligament of Treitz, and the fixation and immobility of this segment of the bowel. Unfortunately, because of the ulcer and the rarity of jejunal tumors, little attention was focused on the rather definite roentgen findings in the small intestine.

A review of the films taken in 1947 (Fig. 1) showed the tumor to have been present at that time, though smaller in size. By 1949 it had grown considerably larger (Figs. 2 and 3), and the jejunum (Fig. 2) at the tumor site and the small intestine proximal to this point for a distance of about 16 cm. showed dilatation, with prominent valvulae conniventes, rouleau effect, and effacement of the normal feathery mucosal pattern. This sign must be interpreted carefully, however, and is not to be confused with overlapping loops of small intestine in this area, which is a common occurrence. The tumor itself is well shown in Figures 3 and 4, appearing as a cauliflower, lobulated mass with flakes of adherent barium within its depressions.

Because of the patient's mental condition, the fluoroscopic examination done in 1947 may not have been entirely satisfactory, and it may be for this reason that the tumor was overlooked. It is our belief, however, that it could have been found at the time of the first examination had adequate films been taken. Only two 10×12-inch films were obtained, and these were insufficient to outline the mass clearly. In our department at the present time we routinely take as many films as is deemed necessary to arrive at a diagnosis, including postero-anterior, oblique, and right lateral views. Particularly do we stress films fifteen to twenty minutes after ingestion of the barium meal, and again at one and a half or two hours, the interval depending upon the rapidity with which the stomach empties itself and the progress of the meal through the small intestine.

On our examination in 1949, we felt that a tumor was present but failed to make a definite diagnosis of adenoma because of the rarity of this tumor and because we failed to utilize the available criteria for diagnosis of this type of tumor as found

elsewhere in the gastro-intestinal tract.

The roentgen findings in a jejunal adenoma are well demonstrated by this case. A mass is seen filling the intestinal lumen and dilating it more or less, depending upon the size of the tumor. The mass is usually lobulated, with retention of barium in its depressions. The dilated intestinal lumen at the tumor site, as well as proximal to it, may show prominent circular folds and absence of the normal mucosal pattern, so that it gives the appearance of numerous loops of bowel superimposed on one another. In a lateral view, the tumor, if of significant size, is usually seen to displace the stomach anteriorly, and frequently becomes outlined by a "halo" of barium around its periphery, due to the interference with flow of barium distally.

On the basis of the criteria presented in this case, we feel that a definite diagnosis of adenoma of the jejunum, in spite of its rarity, can definitely be made from roentgen findings alone.

SUMMARY

1. A case of jejunal adenoma is presented with an associated benign gastric ulcer, persisting over a period of several years.

2. Although the adenoma was large, measuring approximately 5 cm. in diameter, there was no evidence of obstruction, intussusception, or hemorrhage from the tumor.

3. The tumor was suspected from roentgen studies for a considerable period of time prior to surgery, which was performed for the persistent gastric ulcer.

4. The characteristic roentgen picture is described.

NOTE: We wish to express our appreciation to Dr. Edgar R. Pund, Professor of Pathology, Medical College of Georgia, and Consultant to the Veterans Administration Hospital, for the pathological report on this case.

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Adenoma del Yeyuno

Este caso de adenoma yeyunal estaba asociado con úlcera gástrica benigna, habiendo durado varios años. Aunque el adenoma era grande, midiendo unos 5 cm. de diámetro, no produjo signos de oclusión, invaginación o hemorragia. La presencia del mismo fué sospechada desde mucho antes de aplicar la cirugía, que visaba a la persistente úlcera gástrica.

A base de los hallazgos en este caso, parece que es possible hacer radiográficamente un diagnóstico bien definido de adenoma del yeyuno. Obsérvase una tumefacción que llena la luz del intestino y la dilata más o menos conforme al tamaño del tumor. La tumefacción suele ser lobulada, reteniendo el bario en sus depresiones. La dilatada luz intestinal, en el sitio del tumor, así como proximal al mismo, puede revelar pliegues circulares salientes y falta del patrón normal de la mucosa, de modo que ofrece el aspecto de numerosas asas intestinales sobrepuestas una encima de otra. En una vista lateral, puede observarse que el tumor, si alcanza cierto tamaño, desplaza el estómago al frente, y frecuentemente queda demarcado por un "halo" de bario alrededor de su periferia, debido al para del paso del bario distalmente.

Calcinosis Universalis[1]

With Report of a Case

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Calcinosis universalis is a rare and interesting condition of unknown etiology characterized by deposits of calcium in the skin and subcutaneous tissues. The diagnosis is easily made roentgenographically.

Calcinosis is of two types: (*a*) calcinosis circumscripta, in which there are localized collections of calcium in the skin and subcutaneous tissues, usually around the joints, frequently bilaterally; (*b*) calcinosis universalis, in which the calcium is deposited diffusely in the skin, subcutaneous tissues, muscles, and tendons. Occasionally the division is not so clear cut as the above definitions would imply, and individual cases have been classified in either group depending on the author's conception, as noted in the case of Wingfield and Toone (1). Hypodermoliths, constituting a subgroup in the general picture of calcinosis, were described by Piersall (2) in an excellent review, and subsequently a case was reported by Bowen (3). Oosthuizen *et al.* (4) believe that lipocalcinogranulomatosis is a special form of calcinosis universalis, characterized by calcareous deposits of a symmetrical and progressive nature, involving synovial cavities and with associated degeneration of fatty tissue and dystrophic calcification.

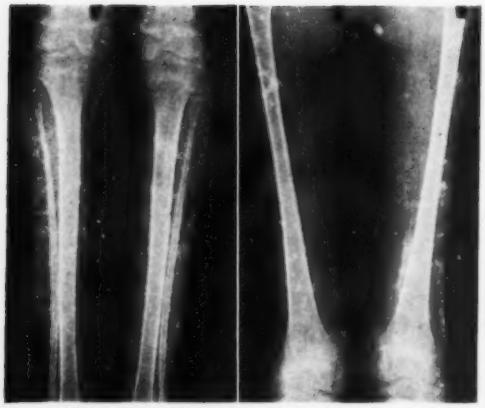
Teissier (5) in 1877 first described calcinosis. In 1878, Weber noted the association of calcinosis with scleroderma, and in 1909 the term calcinosis interstitialis universalis was suggested by Krause and Trappe (quoted by Comroe *et al.*, 8). In 1931, Steinitz (6) reported 71 cases of calcinosis circumscripta and 34 cases of calcinosis universalis. Atkinson and Weber (7) in 1938 collected 138 cases of calcinosis circumscripta, and 78 cases of calcinosis universalis. Comroe *et al.* (8) reviewed the literature up to 1939. Moran (9) published a further review in 1947 and added 2 cases of his own.

It is not the intention to include in the present report cases of calcinosis circumscripta, nor to attempt to evaluate reports in the foreign literature. On this basis, it has been possible to review approximately 26 cases of calcinosis universalis reported since 1938, some 31 per cent of which were associated with scleroderma or dermatomyositis. Approximation in this respect is unavoidable, since 23 per cent of the reports reviewed contain either no roentgenograms or an insufficient number.

The etiology of calcinosis universalis is unknown. Attempts have been made to incriminate disorders of calcium metabolism, intoxication with vitamin D, endocrine disorders, trauma, parathyroid dysfunction, and vascular disturbances (10, 11). The evidence for none of these factors is conclusive. Mulligan (12) in an extensive review of metastatic calcification mentioned, in addition, bone disease and chronic renal disease. It appears that these cases belong to the calcinosis circumscripta group. Parathyroid extracts, high dosages of vitamin D, and mineral diets have been used experimentally to produce metastatic calcifications in animals.

Both calcinosis circumscripta and calcinosis universalis may be associated with scleroderma (13, 14). This association has been reported (7) in 40 per cent of cases of calcinosis circumscripta and 32 per cent of cases of calcinosis universalis. Langmead (15) suggested that calcinosis, scleroderma,

[1] From the Department of Roentgenology, Kings County Hospital, Brooklyn, N. Y. Accepted for publication in November 1951.

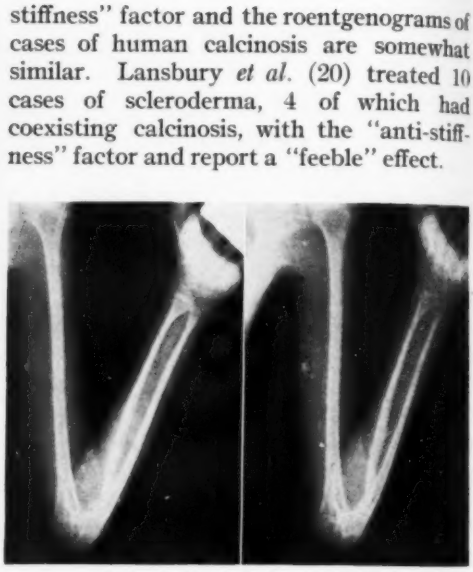


Figs. 1 and 2. Extensive subcutaneous calcifications of the lower extremities.

dermatomyositis, and myositis fibrosa may be parts of a single disease process.

Widmann *et al.* (16) and Goldstein and Abeshouse (17) have discussed the general problem of calcinosis. The calcium deposits consist of calcium carbonate and calcium phosphate in approximately the same proportion as is seen in bone. Interestingly enough, x-ray diffraction studies by Cornbleet *et al.* (18) showed that the calcium deposits from 3 cases of calcinosis circumscripta assumed the apatite pattern.

Of interest in relation to calcinosis is recent work on the production of stiff wrist joints and tissue calcification in guinea-pigs by dietary changes involving calcium and phosphorus (19). Similar changes can be produced by a diet deficient in green vegetables (20). Such deficiency results in a macrocytic anemia, eosinophilia, increased sedimentation rate, and reversal of the albumin-globulin ratio. These changes can be prevented by the addition of fresh kale or raw cream to the deficient diet. When these are given in large amounts, reversal of the calcium deposition can also be achieved. The "anti-stiffness" factor is a fat-soluble vitamin which regulates phosphorus metabolism. Crude sources are green vegetables, raw cream, unheated molasses, and raw sugar-cane juice. The nature of the active principle is still unknown. The roentgenograms of the guinea-pigs showing calcific deposits induced by lack of the "anti-stiffness" factor and the roentgenograms of cases of human calcinosis are somewhat similar. Lansbury *et al.* (20) treated 10 cases of scleroderma, 4 of which had coexisting calcinosis, with the "anti-stiffness" factor and report a "feeble" effect.



Figs. 3 and 4. Calcific deposits in the subcutaneous tissues of the upper extremities.

Cases of calcinosis universalis appear to be about equally distributed between the sexes, with perhaps a slight predominance in females. The signs and symptoms vary with the extent and sites of involvement. The clinical picture ranges from an entire lack of disability, as reported by Peters *et al.* (10), to general disability, severe pain, and marked limitation of motion. The calcium deposits may cause ulceration of the skin, and a sinus, resistant to treatment, may persist. The prognosis is unfavorable. As in any rare entity of unknown etiology, treatment has been unsatisfactory and difficult to evaluate. Ketogenic diets, iodides, roentgen therapy (21), and parathyroidectomy have been recommended. The question of unilateral parathyroidectomy has its controversial aspects (22, 23). In view of the possibility that calcinosis universalis may be part of a collagen disease, cortisone has been recommended as a form of therapy (24).

The differential diagnosis will include chronic renal disease, congenital malformations of the kidney (25), primary and secondary hyperparathyroidism, bone diseases, and hypervitaminosis D. Werner's

syndrome (26) may be excluded, since it is an obscure heredofamilial disease in which scleroderma is associated with bilateral juvenile cataracts, precocious graying of the hair, and endocrine dysfunction. The roentgen appearance in Werner's syndrome is that of extensive calcification within the arterial walls and soft tissues.

CASE REPORT

S. L., a 9-year-old Negro girl, was admitted to the Kings County Hospital because of "weakness." As far as is known, the birth and developmental history up to the age of five years were normal. At that time bullous skin lesions developed in the antecubital fossae, gradually spreading to the remaining portions of the upper extremities and finally to the lower extremities. There was an associated edema of the dorsum of the hands and feet. With the use of local medicaments, the skin lesions gradually disappeared, but after an unknown lapse of time the lower extremities became stiff, and the child was unable to sit up. She could walk without assistance, but with a grotesque, stiff gait, and could play with her dog and eat without help.

Physical examination revealed a poorly nourished, poorly developed, apathetic, listless child, who answered questions intelligently. She was afebrile, and pulse and respirations were normal. Pertinent physical findings were dental caries, a soft systolic cardiac murmur heard best along the left sternal border in the 3rd and 4th intercostal spaces, and fusiform enlargement, with marked limitation of motion, of the joints of the hands, elbows, knees, and ankles. The elbows were held in semiflexion. Grasping power of the hands was extremely poor. No pathologic reflexes were elicited. The extremities were emaciated. The vertebral column was rigid in the lumbar region. The skin was drawn tightly over the face and extremities and had a waxy hard appearance. There were scattered scaly pigmented areas.

Laboratory examinations revealed the following:

Hemoglobin	11 gm.
Red blood cells	5,170,000
White blood cells	7,500
Polymorphonuclears	68%
Lymphocytes	29%
Monocytes	3%
Alkaline phosphatase	7.5 B.U
Total protein	6.4 gm. %
A/G ratio	3.7/2.7
Urine concentration sp. gr.	1.010–1.022
Trichinella precipitin test	Negative
Serologic test for syphilis	Negative
Sickle-cell preparation	Negative
Carbon dioxide content	50 vol. %
Uric acid	2.6 mg. %

Fig. 5. Subcutaneous calcifications in the glutea and lumbosacral regions.

Calcium	9.5 mg. %
Phosphorus	4.7 mg. %
Urea	27 mg. %
Sugar	81 mg. %
Chlorides	560 mg. %
Creatinine	0.44 mg. %
Creatine	1.16 mg. %

An electrocardiogram showed sinus tachycardia and right axis deviation.

It was the unanimous opinion at the Staff Conference of the Department of Dermatology that the patient had dermatomyositis. Unfortunately, permission could not be obtained for a skin biopsy.

Figures 1 to 4 reveal the extensive subcutaneous calcifications of the extremities. Figure 5 demonstrates the subcutaneous calcifications in the gluteal and lumbosacral regions. Subcutaneous calcifications were present also along the medial borders of both feet. The examinations of the skull and chest failed to reveal any abnormal calcifications.

SUMMARY

A brief review of calcinosis interstitialis universalis and a case with associated dermatomyositis are presented.

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SUMARIO

Calcinosis Universal

Después de repasar el tema de la calcinosis intersticial universal, preséntase un caso en el que las extensas calcificaciones subcutáneas estaban asociadas a lesiones bulosas de la piel y edema de las manos y los pies. Los dermatólogos classificaron el estado como dermatomiositis; no se concedió permiso para ejecutar una biopsia.

Preoperative Roentgen Demonstration of Non-Opaque Foreign Body in the Duodenum

Report of a Case[1]

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Detroit, Mich.

THE ROENTGEN demonstration of opaque foreign bodies in the gastrointestinal tract is a common occurrence. This is especially true in children who swallow metallic objects, which are usually followed for a few days and passed naturally without event. Demonstration of non-opaque foreign bodies, on the other hand, is a much rarer occurrence and correspondingly more difficult. Their presence is usually suspected only after the occurrence of an abdominal catastrophe, necessitating emergency surgical intervention.

A common manifestation of the presence of a foreign body in the alimentary tract is intestinal obstruction, bezoars of different varieties being the most commonly reported offenders (1). Ingested dried fruit has been implicated, and even a distended condom has been found in a patient with intestinal obstruction (2). The other serious complication has been intestinal perforation. The most frequently reported causes of perforation are the radiopaque chicken and fish bones. Of non-opaque foreign bodies causing perforation, the common wooden toothpick has been previously reported (3 and 4).

A review of the general medical and radiological literature for the past twelve years fails to reveal any instance in which the diagnosis of a non-opaque foreign body within the intestine was made by roentgen methods before the development of major complications. This, of course, does not include the not infrequent cases of worm infestation demonstrated with the aid of the barium meal. The present case is reported because of the roentgenologic demonstration of an intra-intestinal non-opaque foreign body (toothpick) in the absence of a helpful clinical history and before the need for surgical intervention became clinically apparent. It also presents a somewhat unusual symptom complex which might have been considered functional in the absence of positive roentgenologic findings.

CASE REPORT

R. V., a 25-year-old white mechanic, was first seen in the Lynn Clinic on Aug. 13, 1951, complaining of recurrent transient abdominal pains. He had been well until three weeks previously. The pain seemed to start in the right lower quadrant and then spread to the flanks and periumbilical region. The discomfort lasted only a few minutes and disappeared only to recur after an unpredictable asymptomatic interval. There was no rhythmicity to the pain and it bore no relation to food or food types. There was no associated nausea, vomiting, or change in bowel habit. Melena had not been present at any time. The past history was of no significance. There had been no abdominal surgery. The family history was non-contributory.

Findings on physical examination were normal, with no evidence of local tenderness. Laboratory studies were all normal.

X-ray examination showed a normally functioning gallbladder but roentgenograms of the gastrointestinal tract demonstrated a tubular filling defect in the duodenum, just at the ligament of Treitz, which persisted on follow-up small-bowel films (Figs. 1 and 2). It was suggested that this represented a non-opaque foreign body or possibly worm infestation. The patient was closely questioned but denied any knowledge of having ingested a foreign body. He was placed on a bland diet and seemed to improve until Aug. 30, about three weeks later, when he again presented himself with a severe manifestation of the same complaints. He was admitted to the Lynn Hospital, and symptoms subsided with no specific treatment. Repeat studies of the gastrointestinal tract again showed the foreign body, unchanged in position (Fig. 3). At this time the patient recalled swallowing a toothpick about three

[1] From the Department of Radiology, Lynn Clinic and Hospital, Detroit, Mich. Accepted for publication in November 1951.

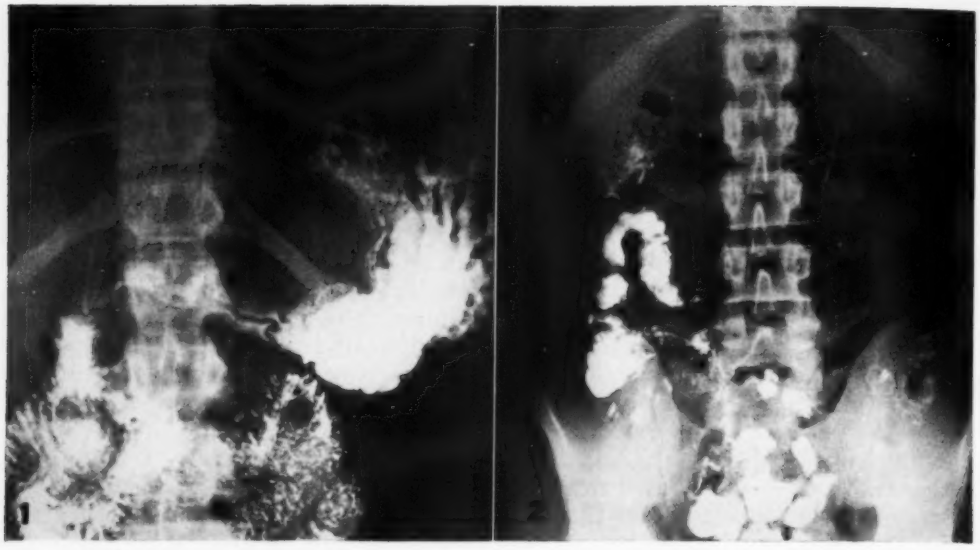

Fig. 1. .Tubular defect surrounded by barium in the third portion of the duodenum at the ligament of Treitz.
Fig. 2. Residual barium surrounding mucus-encased toothpick as demonstrated on delayed films.

Fig. 3. Distortion of third portion of the duodenum, with "stretching" by the foreign body. Seventeen days after original examination.

weeks prior to the onset of symptoms. He was again discharged but returned with a recurrence of symptoms. At his request, the gastrointestinal examination was repeated, and again showed the foreign body. Because of the persistence of symptoms and the danger of perforation, it was decided that the foreign body should be removed.

On Sept. 14, 1951, operation was performed by Dr. David H. Lynn, and an ordinary wooden toothpick was removed from the duodenum just at the level of the ligament of Treitz. The toothpick (Fig. 4) was encased in a mucoid shell but no evidence of perforation was seen. The postoperative course was uneventful and brief follow-up has shown the patient to be asymptomatic and apparently normal.

Although the literature would suggest that non-opaque foreign bodies are rare, it is felt that this condition more often represents the cause of gastrointestinal complaints than is generally suspected. Preoperative roentgen demonstration was not difficult in the case reported, but one should not always expect such a fortuitous combination of circumstances. It again demonstrates the aid the radiologist can offer to his clinical colleagues in obtaining an accurate history and re-emphasizes the importance of small bowel films in routine gastrointestinal roentgenography. More widespread use of such films should lead to the more frequent diagnosis of non-opaque foreign body.

Fig. 4. Toothpick after removal.

SUMMARY

1. A case of non-opaque foreign body in the gastrointestinal tract diagnosed preoperatively by roentgen methods is presented.

2. The rarity of this situation is emphasized.

3. The suggestion is advanced that the absence of reported cases is not a true indication of their frequency and that non-opaque foreign bodies would be more commonly found with wider use of routine small-bowel films.

2900 S. Fort St.
Detroit 25, Mich.

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1. STALKER, L. K., AND GOTHAM, I. J., JR.: Small Bowel Obstruction Due to Phytobezoar. New York State J. Med. **50:** 1614, July 1, 1950.
2. WEINSTEIN, M., ROBERTS, M., AND SASS, E.: Intestinal Obstruction Caused by Unusual Foreign Body. Gastroenterology **14:** 566–567, April 1950.
3. SALETTA, F. J., AND RUKSTINAT, G. J.: Tooth Pick Perforation of the Ileum. Illinois M. J. **93:** 276–277, May 1948.
4. BORTAGARAY, C. A., AND DEFINO, A.: Perforation of the Sigmoid by Ingested Foreign Body (Toothpick). Arch. urug. med. **36:** 454–458, May 1950.

SUMARIO

Descubrimiento Roentgenológico Preoperatorio de un Cuerpo Extraño No Opaco en el Duodeno

El caso comunicado es de cuerpo extraño no opaco—mondadientes de madera—en el tracto gastrointestinal.

El enfermo experimentaba dolor intermitente sin relación con las comidas ni asociación con síntomas gastrointestinales. El examen roentgenológico reveló un nicho tubular en el duodeno, junto al ligamento de Treitz, que persistía, al tomarse después radiografías del intestino delgado. Se consideró que esto representaba un cuerpo extraño, y los exámenes subsiguientes demostraron que no había variado la posición. Recordó entonces el sujeto que había tragado un palillo de dientes, el cual fué extraído en una operación.

Es probable que, con un empleo más amplio de radiografías del intestino delgado se encontrarían más menudo cuerpos extraños no opacos.

Pseudo-Albuminuria Following Monophen and Priodax[1]

E. E. SEEDORF, M.D., W. N. POWELL, M.D., R. G. GREENLEE, M.D., and D. N. DYSART, M.D.

Temple, Texas

THE INCIDENCE of pseudo-albuminuria following the ingestion of Priodax was reported in 1950 (1). Another cholecystographic drug, Monophen, has since become available. This drug has the chemical name of 2-(4-hydroxy-3, 5-diiodobenzyl)-cyclohexane carboxylic acid. It is supplied in 0.5-gram cellophane-sealed capsules by Bell-Craig, Inc., formerly National Synthetics, Inc.[2] The ingestion of six capsules of Monophen generally produces a gallbladder shadow of density equal to that produced by six tablets of Priodax.

After corresponding with a number of clinical laboratories, it was learned that various methods are used for detecting the presence of albumin in the urine. Exton's reagent, or a modified form of the sulfosalicylic acid test, is most universal, but Heller's ring test, Robert's reagent, and heat and nitric acid are also employed. In our previous investigation with Priodax, Exton's reagent was the only test applied to all urine specimens.

A study of 100 patients receiving Priodax and 100 patients receiving Monophen fourteen hours prior to urinalysis was made at the Scott and White Clinic to determine how these two media compare as to incidence of "false" albuminuria and as to undesirable side reactions. It was decided to apply each of the above-mentioned albumin detection tests to all urine specimens. Analyses of specimens from a selected number of patients ingesting Priodax and an equal number ingesting Monophen were made daily.

Table I presents the number and/or percentage of false "positive" reactions for urine albumin with these various tests. This table demonstrates that the incidence of "false" albuminuria is about the same whether Priodax or Monophen is used. For example, Exton's reagent, the reagent employed in most laboratories, produced a false test for albumin in 14 per cent of the patients receiving Priodax and in 17 per cent receiving Monophen. It was noted that when the Exton test for albumin was made without heating, the incidence of clouding was much greater. The incidence of pseudo-albuminuria was much higher with nitric acid and heat than with Exton's reagent, heated, and with Robert's reagent it reached about 75 per cent. (Our previous report of 100 patients ingesting Priodax demonstrated a "false" albuminuria in 36 per cent of the patients. This discrepancy cannot be explained, since both series of urinalyses were conducted in an identical manner.)

TABLE I: INCIDENCE OF FALSE ALBUMINURIA FOLLOWING INGESTION OF PRIODAX AND MONOPHEN

Laboratory Test	Priodax	Monophen
Exton's reagent (hot)	14	17
Exton's reagent (cold)	60	65
Heller's ring test	10	10
HNO_3 and heat	43	39
Robert's reagent	72	82

The presence or absence of pathological findings on the cholecystogram did not alter the incidence of pseudo-albuminuria following the use of either drug. In a small number of patients, this "false" albuminuria was present for two or three days. As was previously reported concerning Priodax, the incidence of "false" albuminuria following the use of Monophen was proportionately greater in lighter weight individuals.

Our earlier paper mentioned that no correlation was demonstrable between the specific gravity, microscopic picture, or

[1] From the Department of Radiology (Dr. Seedorf; Dr. Dysart, Resident in Radiology), the Department of Clinical Pathology (Dr. Powell), and the Department of Medicine (Dr. Greenlee) of the Scott and White Clinic. Accepted for publication in December 1951.

[2] This company donated a generous supply of Monophen capsules for this investigation.

pH of the urine specimens, or between varying barometric pressures and temperatures and the incidence of "false" albuminuria following ingestion of Priodax. The present study demonstrated a similar lack of correlation with Monophen.

A comparison of the number and/or percentage of undesirable side reactions occurring among the 100 patients who received Priodax and the 100 who received Monophen is presented in Table II.

TABLE II: SIDE REACTIONS WITH PRIODAX AND MONOPHEN

Undesirable Reactions	Priodax	Monophen
Dysuria	48	23
Diarrhea	38	13
Abdominal cramps	21	19
Nausea	17	28
Vomiting	0	0
Headache	21	27
Dizziness	15	14
Visual disturbance	2	4

Dysuria, diarrhea, abdominal cramps, and nausea occurred following the ingestion of Priodax with about the same frequency as reported by Stevenson and Smith (2). With the exception of nausea, these symptoms were observed less frequently among the patients receiving Monophen. It is believed that the large size of the Monophen capsules, six of which must be swallowed, produces a psychic repulsion on the part of some patients, accounting for the higher incidence of nausea from Monophen. None of the patients in this series receiving either Priodax or Monophen complained of vomiting. Headache, dizziness, and visual disturbances generally occurred early in the morning of the day following ingestion of the medium, and lasted only a short time. They probably had little relation to the drug used. We observed no allergic phenomena attributable to the drugs.

SUMMARY AND CONCLUSIONS

The incidence of pseudo-albuminuria in patients following ingestion of Priodax and Monophen is reported. Monophen appears to produce a slightly higher incidence of "false" albuminuria, but is less prone to produce undesirable side reactions than Priodax.

A report of albuminuria in patients who have ingested either Priodax or Monophen should be interpreted with caution. This is of particular importance when Robert's reagent or the nitric acid and heat test is employed.

The two drugs are comparable in their production of good cholecystograms.

Scott and White Clinic
Temple, Texas

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2. STEVENSON, C. A., AND SMITH, R. N., JR.: Comparison of Two Cholecystographic Media. Texas State J. Med. **42:** 492–494, December 1946.

SUMARIO

Seudoalbuminuria Consecutiva al Monofén y al Priodax

Los análisis urinarios ejecutados con varias técnicas después de la administración de Monofén y de Priodax para la colecistografía mostraron una incidencia ligeramente mayor de albuminuria "falsa" después de tomar Monofén. No obstante, este último medio pareció ser menos susceptible de provocar reacciones contraproducentes.

Hay que interpretar con cautela todo informe de albuminuria en enfermos que han ingerido ya Priodax o Monofén. Esto reviste aun mayor importancia cuando se emplean el reactivo de Robert o alguna forma de los ácidos nítrico o acético y pruebas térmicas.

Las dos drogas son comparables en su producción de colecistogramas de buena calidad.

Nota: Priodax = Acido beta-(4-hidroxi-3,5-diyodofenil)-alfa-fenil-propiónico. Monofén = Acido 2-(4-hidroxi-3,5-biyobencil)-ciclohexano-carboxílico.

EDITORIAL

Invitation to the Annual Meeting

The Thirty-eighth Annual Meeting of the Radiological Society of North America will be held at the Netherland-Plaza Hotel, Cincinnati, Ohio, Dec. 8 through Dec. 12, 1952. As your President and in behalf of your officers and the members of the many committees who are working diligently to make this meeting a success, I cordially invite you to the 1952 meeting and urge you to attend.

The General Program of the Radiological Society will be presented in the Netherland-Plaza Hotel. Each day, Monday through Friday, beginning at 8:30 A.M. and closing at 10:00 A.M., Refresher Courses will be held. These will be followed by Scientific Sessions starting at 10:30 each morning and closing at 12:30 P.M. The afternoon Sessions will begin at 2:00 P.M. and close at 4:30 P.M. except on Friday, when there will be a single Scientific Session closing at 1:00 P.M. Executive Business Sessions will be held Monday, Tuesday, and Thursday at 4:30 P.M.

A feature of this year's meeting will be an historical lecture on the life of Walter Bradford Cannon by George W. Holmes, M.D., Emeritus Professor of Radiology of the Harvard University Medical School, Past Director of the Department of Radiology of the Massachusetts General Hospital, and now head of the Department of Radiology of the Waldo County Memorial Hospital, Belfast, Maine. Dr. Holmes is well known to most of us and is one of the greatest of American radiologists.

Radiation physicists, biologists, and other allied scientists have contributed greatly to the development of the science of Radiology, and many are and long have been valued members of our Society. Our program this year will differ from previous ones in that a separate Section Meeting for the Allied Scientists will be held at the Sheraton-Gibson Hotel each morning, beginning Tuesday and extending through Friday. This division of our Program will include Refresher Courses, three in number, each morning, starting at 8:30 and continuing until 10:00 A.M. A General Session consisting of papers and discussions will follow, beginning at 10:30 A.M. and closing at 1:00 P.M. Although the work of this Section is directed primarily toward the Allied Scientists, many of the Refresher Courses and presentations unquestionably will be of great interest to a significant number of physicians specializing in Radiology. The Refresher Courses have been planned under the able leadership of Edith H. Quimby, Sc.D., of Columbia University, New York, and a Scientific Program of wide interest and highest quality has been arranged by Lauriston S. Taylor, Ph. D., of the Bureau of Standards, Washington, D. C.

A Local Committee, with Mrs. Harold Reineke of Cincinnati as Chairman, has planned an interesting program for the visiting ladies. The Annual Banquet will be held Thursday evening. Appropriate entertainment will be a feature, and the occasion will be such that all will wish to attend.

From the standpoint of convenience of transportation, Cincinnati is a most satisfactory meeting place. Hotel facilities are adequate and of excellent quality. There are many places of interest in and about the city, and we are assured of a most pleasant and successful meeting.

JOSEPH C. BELL, M. D.
President

ANNOUNCEMENTS AND BOOK REVIEWS

NEW YORK ROENTGEN SOCIETY

The following newly elected officers of the New York Roentgen Society assumed office on September 1: President, John L. Olpp, M.D., of Tenafly, N. J.; Vice-President, Irving Schwartz, M.D.; Secretary, Harold W. Jacox, M.D., 622 W. 168 St., New York 32; Treasurer, J. R. Freid, M.D.

NORTH DAKOTA RADIOLOGICAL SOCIETY

The following new officers were elected by the North Dakota Radiological Society at a recent meeting: President, Dr. Charles Heilman of Fargo; Vice-President, Dr. Philip H. Woutat of Grand Forks; Secretary-Treasurer, Dr. H. M. Berg, Quain and Ramstad Clinic, Bismarck.

The Society meets every Spring at the time of the meeting of the State Medical Association, and once during the Fall or Winter, on announcement.

RADIOLOGICAL HEALTH TRAINING PROGRAM

Announcement has been made of a radiological health program sponsored by the Public Health Service. One phase of this program is a series of short training courses to be conducted at the Environmental Health Center in Cincinnati, Ohio. These courses are offered to qualified applicants without cost for tuition. Their primary objective is to assist health department employees and key personnel in other governmental or private organizations in achieving an understanding of the hazards and problems related to x-rays, radioelements, neutron fluxes, and particle accelerators. This training is designed for professional workers who are concerned with radiological health problems in their respective fields. Candidates should have a degree in medicine, engineering, or science (physical or biological).

Three units or courses of two weeks each will be given: Basic, Intermediate, and Advanced. All three courses may be taken consecutively, as a six-week unit, or the Basic and Intermediate Courses may be taken consecutively as a four-week unit, or any course may be taken individually, providing entrance requirements are fulfilled.

The *Basic Course* provides training in the theory of radiation and radiation detecting instruments, the calibration and use of these instruments, the detrimental effects of radiation, the means of shielding and protection against radiation, and permissible radiation exposure levels. Basic Courses are scheduled as follows: Oct. 6–17, 1952; Jan. 19–30, 1953; April 20–May 1, 1953.

The *Intermediate Course*, designed for those who have had the equivalent of the Basic Course, covers area and personnel monitoring, the radioassay of water, food, sewage and biological samples, and the operation, maintenance, and repair of radiation detection instruments. Intermediate Courses are scheduled for Oct. 20–31, 1952; Feb. 2–13, 1953; May 4–15, 1953.

An *Advanced Course* is being presented for professional personnel who are concerned in particular with *occupational* radiological health problems. It is offered to persons who have satisfactorily completed the Intermediate Course, or an equivalent training program. This course is scheduled for Feb. 16–27, 1953.

Further details and information may be obtained by addressing Chief, Radiological Health Training Section, Public Health Service, Environmental Health Center, 1014 Broadway, Cincinnati 2, Ohio.

DR. JOHN M. KEICHLINE

Dr. John M. Keichline, of Huntingdon, Penna., long a member of the Radiological Society of North America, was honored by fellow members of the Huntingdon County Medical Society, the Kiwanis, Rotary, and Lions Clubs, and others, on July 9, at a dinner celebrating his completion of fifty years of medical practice.

Dr. Keichline has practised his profession in Pennsylvania since 1907, except for an interval at Battle Creek Sanitarium, where he was engaged in postgraduate work in radiology, physical therapy, and anesthesiology. He has served his State and County Medical Societies as President and in 1942 was a Vice-President of the Radiological Society of North America. He has, also, a long record of community service with the Boy Scouts, Red Cross, Tuberculosis Society, Rotary Club, and American Legion.

RADIOLOGY not only congratulates Dr. Keichline for his years of able service to medicine and the specialty of radiology but extends its felicitations to the citizens of Huntingdon among whom he has worked so long and faithfully.

Letter to the Editor

To the Editor of Radiology

DEAR DR. DOUB:

The success, and the present and future safety of our democratic form of government, rest primarily on the informed interest of our citizens and their active participation in their government. The privilege of voting is guaranteed by our Constitution; it is one of our most cherished privileges, but it is the duty of all qualified individuals as well. Today our nation is

beset by many dangers, and never more than now has intelligent, conscientious support of our citizens, as expressed by ballot, been of greater importance.

May I through the columns of RADIOLOGY address the following request to the members of our Society:

As your President, I urge you, the members of the Radiological Society of North America, to let nothing interfere with the casting of your ballot November next. Likewise, may I request that you advise all employees, and others with whom you are closely associated, to register if they have not already done so and are qualified, and in the coming Fall election to vote thoughtfully and conscientiously for the men and movements that, in their considered opinion, will best serve the needs of our country.

On Election Day in November during the first hour following the customary time of opening, may I request that no work other than emergencies be scheduled in your office or the hospital radiological department with which you may be associated, thus affording an opportunity for you, your associates, and assistants to vote. This provision will serve a second purpose, in that the delay in opening will come to the attention of other physicians and medical workers, and will remind them of their voting duty.

JOSEPH C. BELL, M.D.
President

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

DIE ZEREBRALE ANGIOGRAPHIE. By H. KRAYENBÜHL, Professor für Neurochirurgie, Direktor der Neurochirurg Universitätsklinik Zürich, AND Hs. R. RICHTER, Assistent, der Neurochirurg. Universitätsklinik Zürich. A volume of 218 pages, with 100 illustrations. Published by Georg Thieme, Stuttgart, 1952. Distributors for the U. S. A. and Canada: Grune & Stratton, Inc., New York, N. Y. Price, DM 59.70

LEHRBUCH DER RÖNTGENDIAGNOSTIK. By H. R. SCHINZ, W. E. BAENSCH, E. FRIEDL, E. UEHLINGER, with contributions by E. BRANDENBERGER, A. BRUNNER, U. COCCHI, N. P. G. EDLING, J. EGGERT, F. K. FISCHER, M. HOLZMANN, H. KRAYENBÜHL, Å. LINDBOM, E. LINDGREN, G. A. PREISS, S. WELIN, AND A. ZUPPINGER. 7. Leiferung. Published by Georg Thieme, Stuttgart, 1952. Distributors for the U. S. A. and Canada: Grune & Stratton, Inc., New York, N. Y. Price, DM 89.00.

DIE KRANKHEITEN DER NASENNEBENHÖHLEN, DER OHREN UND DES HALSES IM RÖNTGENBILD. Ergänzungsband 45, Fortschr. a. d. Geb. d. Röntgenstrahlen. By PROF. DR. RICHARD MITTEMEIER, Direktor der Universitäts-Hals-Nasen-Ohren-Klinik, Marburg/Lahn. Zweite vermehrte und überarbeitete Auflage. A volume of 232 pages, with 483 illustrations. Published by Georg Thieme, Stuttgart, 1952. Distributors for the U. S. A. and Canada: Grune & Stratton, Inc., New York, N. Y. Price, DM 66.00

DER GESUNDE UND DER KRANKE KEHLKOPF IM RÖNTGENBILD. By PROF. DR. MED. C. R. GRIEBEL, Bad Nauheim. A volume of 172 pages with 156 illustrations. Published by Georg Thieme, Stuttgart, 1952. Distributors for the U. S. A. and Canada: Grune & Stratton, Inc., New York, N. Y. Price, DM 48.00

DIE OSTEOMALAZIE. By DR. MED. MARKUS WERNLY, Bern. A monograph of 102 pages, with 16 illustrations and 1 table. Published by Georg Thieme, Stuttgart, 1952. Distributors for the U. S. A. and Canada: Grune & Stratton, Inc., New York, N. Y. Price, DM 14.40

CHRONIC OTITIS. A CRITICAL ANALYSIS. Supplement to Vol. 19, Practica Oto-rhino-laryngologica. By MARCUS DIAMANT, M. D., Head of the Ear, Nose and Throat Department, The Central County Hospital, Halmstad, Sweden. A volume of 190 pages, with 35 figures and 1 portrait. Published by S. Karger, Basle, Switzerland, 1952.

REFRESHER COURSES: POSTGRADUATE INSTRUCTION

The 1952 Refresher Course Series will be presented during the Thirty-eighth Annual Meeting of the Radiological Society of North America at the Netherland-Plaza Hotel and the Sheraton-Gibson Hotel in Cincinnati, Ohio. The courses will open with Therapy Information—Problem Cases, at 2:30 P.M. Sunday, Dec. 7, followed by a Film-Reading Session at 7:00 P.M. Commencing on Monday Dec. 8, there will be six clinical courses daily from 8:30 to 10:00 A.M. at the Netherland-Plaza, with twelve additional courses (three daily, Tuesday through Friday) on related sciences, at the Sheraton-Gibson. No other meetings will be scheduled during these hours. Attendance is limited to the medical profession (M.D.'s), including graduate students and residents in radiology; allied scientists, such as radiation physicists, radiobiologists, chemists, and others closely concerned with the science of radiology; and medical students certified by the Deans of their respective medical schools.

A registration fee of $15.00, which includes the Refresher Course fee must be paid by all nonmembers of the Radiological Society of North America. The exceptions are guest speakers, guest instructors, residents or fellows in radiology, students, and officers in the Armed Forces of the United States on temporary duty and away from their practices. Members and members-elect of the Radiological Society of North America do not pay a registration fee or a Refresher Course fee. All must register at the registration desk in the Netherland-Plaza Hotel. Admission to the Refresher Courses will be by presentation of the registration badge and a ticket for the particular course.

Read the description of the courses, noting particularly the days upon which they are offered and make your selection for each day. State your first, second, and third preferences, for the number attending each course will be limited by the seating capacity of the room. You will be notified regarding your selections, and all tickets will be picked up at the Netherland-Plaza at the time of registration.

Course No. 1: Sunday, 2:30–5 P.M.

Therapy Information—Problem Cases

THEODORE P. EBERHARD, M.D., Philadelphia, Penna.
Moderator

JUAN A. DEL REGATO, M.D., Colorado Springs, Colo.
ISADORE LAMPE, M.D., Ann Arbor, Mich.
JAMES F. NOLAN, M.D., Los Angeles, Calif.
FRANZ J. BUSCHKE, M.D., Seattle, Wash.
RALPH M. CAULK, M.D., Washington, D. C.
JOHN HALE, M.S., Philadelphia, Penna.

Representative cases involving the clinical application of x-rays, radium, and radioisotopes will be presented to the members of the panel, who will be asked for their opinions as to how they would have treated the case, and the way these were actually handled.

Course No. 2: Sunday, 7–9 P.M.

Film Interpretation Session

L. HENRY GARLAND, M.D., San Francisco, Calif.
Moderator

PAUL C. SWENSON, M.D., Philadelphia, Penna.
LEO G. RIGLER, M.D., Minneapolis, Minn.
EARL R. MILLER, M.D., San Francisco, Calif.

This session is a diagnostic symposium designed to illustrate basic principles of film interpretation, including differential diagnosis. Only proved cases will be shown, and all will be diagnosable either from the films, the history, the fluoroscopic findings, or a combination of these data.

The cases will be chosen largely from material submitted by members of the Pacific Roentgen Society. However, any member of the Radiological Society who desires to present an instructive case may submit his material to the Moderator, Dr. L. Henry Garland, 450 Sutter St., San Francisco 8, Calif.

Course No. 3: Monday, 8:30–10 A.M.

Lesions of the Chest in Infants and Children

JOHN F. HOLT, M.D.
University Hospital, Ann Arbor, Mich.

A review of predominantly non-tuberculous abnormalities encountered in general hospital practice, with particular emphasis upon confusing normal anatomical shadows and anatomic variants.

Course No. 4: Monday, 8:30–10 A.M.

Pulmonary Physiology and Pulmonary Function Tests

JULIUS H. COMROE, JR., M.D.
Graduate School of Medicine, University of Pennsylvania
Philadelphia, Penna.

This course will begin with a brief review of pulmonary physiology and will then consider in detail the various physiologic tests which are used to measure and evaluate pulmonary function. This will include tests which measure:

A. Ventilation (lung volumes, tidal volume, minute volume, dead space, alveolar ventilation, and the distribution of inspired gas)

B. Diffusion (carbon monoxide technics, alveolar arterial gradients)

C. Pulmonary circulation (volume and pressure of blood in the pulmonary circulation)

D. The mechanical factors in breathing (MBC, spirograms, and the work of breathing)

The relationship between physiologic and radiologic tests of pulmonary function will be emphasized, and the role of pulmonary function tests in diagnosis will be discussed.

(*This course continued Tuesday, Course No. 10*)

Course No. 5: Monday, 8:30–10 A.M.

Treatment of Cancer of the Skin and Lip

BERNARD PIERRE WIDMANN, M.D.
Philadelphia, Penna.

Cancers of the skin and lip are radiologic problems. The clinical and cosmetic results are not only satisfactory but very often dramatic. Lesions at these anatomic sites are amenable to cure by a wide variety of irradiation procedures. It will be the object of this discussion to present an analysis of the technics that have been described in the literature. Different types of radiation—contact, low-voltage (80–125 kv. ranges), high-voltage (200 kv.), as well as radium in the form of contact applicators or interstitial procedures—will be reviewed. A mathematical formula will be presented from which variations in daily rate and intensity may be selected according to circumstances and the convenience of the patient.

The management of large, bulky, or advanced lesions, often hopeless and incurable, as well as small lesions, will be discussed.

The management and treatment of complications will also be considered, and technical procedures of irradiation for angioma will be presented.

Course No. 6: Monday, 8:30–10 A.M.

The Anatomical Basis for Venographic Interpretation, with New Developments in Methods of Venography

DAVITT A. FELDER, M.D.
University of Minnesota Medical School
Minneapolis, Minn.

I. Anatomy of the veins of the lower extremities
  A. History
  B. Application
II. Physical dynamics of radiopaque media in blood vessels
  A. Effect of specific gravity and viscosity on flow
  B. Mixing and diluting effects of blood
  C. Effect of exercise and gravity on flow
  D. Dynamics in retrograde injections
III. Methods of venography
  A. Physiological
  B. Retrograde

Course No. 7: Monday, 8:30–10 A.M.

Roentgen Diagnosis of the Arthropathies

A. A. deLORIMIER, M.D.
Saint Francis Memorial Hospital, San Francisco, Calif.

Casual observation of roentgenograms of joints may lead one to identify most cases either as atrophic or hypertrophic "arthritis." This stunted point of view may be due to improper technical precaution; it may be due to lack of comprehensive thinking with respect to the common types of arthropathies; it may be due to oversight of tangible roentgen criteria. These three aspects of responsibility on the part of roentgenologists will be considered with portrayals by lantern slides.

The Peripheral Joints

Developmental Malformations
Osteochondritis
  Specific
    Congenital syphilis
    Rickets
    Scurvy
  Nonspecific
    Juvenile types: Legg-Perthes, Osgood-Schlatter, Köhler's, Freiberg's infraction, Sever's disease, etc.
    Adult types
Group in which Changes Are Essentially Concerned with Mechanical Stresses
  Degenerative joint disease—osteoarthritis
    Traumatic
    Static
    Senescent
  Hemorrhagic arthropathies
  Neuroarthropathies
    Concerned with efferent nerve loss
    Concerned with afferent nerve loss
    Paraplegic joints
Group Essentially Concerned with Protein Reactions, Toxins, or Actual Bacterial Invasion of the Joint—True Arthritides
  Peritendinitis, tendinitis
  Allergic arthropathies, including rheumatic fever
  Toxin arthropathies: rheumatoid arthritis
  Infectious arthritis
Gout
Neoplasms Benign and Malignant
Peripheral Arthralgias: Miscellaneous Causes

The Joints of the Spine

Developmental Malformations
Spondylolisthesis
Osteochondritis
Group in Which Changes are Essentially Concerned with Mechanical Stresses
  Degenerative Joint Disease—Osteoarthritis
    Traumatic
    Static
    Senescent

Neuroarthropathies
Concerned with efferent nerve loss
Concerned with afferent nerve loss
Group Essentially Concerned with Protein Reactions, Toxins or Actual Bacterial Invasion of the Joint
Toxin arthropathies: rheumatoid spondylitis
Infectious arthritis
Ochronosis
Neoplasms
Spinal Arthralgias: Miscellaneous Causes

The Temporomandibular Joints

Arthropathies, Traumatic, Rheumatoid, Infectious

(*This course continued Tuesday, Course No. 13*)

Course No. 8: Monday, 8:30–10 A.M.

Lesions of the Esophagus, Stomach, and Duodenum

CESARE GIANTURCO, M.D.
Carle Hospital Clinic, Urbana, Ill.

This course will consist of a lantern-slide demonstration of lesions of the esophagus, stomach, and duodenum. Particular emphasis will be placed upon the correlation of various gastrointestinal studies in the course of a general radiological visceral survey. The use of compression methods and of the double-contrast technic for the examination of the gastric mucosa will be discussed in detail.

(*This course continued Tuesday, Course No. 14*)

Course No. 9: Tuesday, 8:30–10 A.M.

Radiological Diagnosis of Congenital Malformations of the Heart and Great Vessels

M. H. WITTENBORG, M.D.
The Children's Medical Center, Boston, Mass.

The content of this course will include the roentgenoscopic and roentgenographic characteristics of congenital heart disease, with emphasis on the simpler methods of diagnosis. The indications for the more elaborate studies of angiocardiography and cardiac catheterization will be discussed.

Course No. 10: Tuesday, 8:30–10 A.M.

Pulmonary Physiology and Pulmonary Function Tests

JULIUS H. COMROE, JR., M.D.

(*Continued from Monday, Course No. 4*)

Course No. 11: Tuesday, 8:30–10 A.M.

Carcinoma of the Male Genital System

MILTON FRIEDMAN, M.D.
New York University Post-Graduate Medical School
New York, N. Y.

Urological lesions of radiotherapeutic interest will be discussed. Tumors of the testis will be considered from the standpoint of histogenesis, radiosensitivity and tumor lethal dose classification; indications for irradiation, and x-ray therapy technic.

Bladder carcinoma will be discussed from the standpoint of radiosensitivity classification, interstitial and other radium technics, and external roentgen therapy with special reference to supervoltage rotation therapy. The Walter Reed radium technic will be described in detail. Briefer consideration will be given to neuroblastoma of the adrenal, Wilms' tumor, and Peyronie's disease.

Course No. 12: Tuesday 8:30–10 A.M.

Fractures of the Extremities

THEODORE H. VINKE, M.D.
University of Cincinnati College of Medicine
Cincinnati, Ohio

This course will start with a general review of ordinary fractured bones. The interpretation of roentgenograms of these fractures as related to the clinical, physical, and physiological points of view will be presented.

More complicated fractures, requiring intramedullary nailing of various types and prosthetic replacement devices, will be described and illustrated.

Obscure and infrequent types of fracture will then be shown and their relationship to clinical symptoms and function described.

The first period will be devoted to fractures of the bones of the upper extremity and the second period to fractures of the lower extremity.

Time will be reserved for questions.

(*This course continued Wednesday, Course No. 18*)

Course No. 13: Tuesday, 8:30–10 A.M.

Roentgen Diagnosis of the Arthropathies

A. A. deLORIMIER, M.D.

(*Continued from Monday, Course No. 7*)

Course No. 14: Tuesday, 8:30–10 A.M.

Lesions of the Esophagus, Stomach, and Duodenum

CESARE GIANTURCO, M.D.

(*Continued from Monday, Course No. 8*)

Course No. 15: Wednesday, 8:30–10 A.M.

Anomalies of the Urinary Tract in Children

L. L. KLOSTERMYER, M.D.
Asheville, N. C.

It has been stated that urinary tract anomalies are present in at least 5 per cent of all newborn infants. Their frequency and variety, the high morbidity and mortality incident to many malformations, plus the fact that proper treatment often results in cure, emphasize the importance of accurate, complete diagnosis at the earliest opportunity. "Urography is probably the greatest single aid in the urologic diagnosis" (Campbell).

Most of the known anomalies of the urinary tract will be demonstrated by lantern slides. Methods of study, embryology, and clinical features will be considered.

Course No. 16: Wednesday, 8:30–10 A.M.

Radiological Aspects of the Chest in Industry

EUGENE P. PENDERGRASS, M.D.
University of Pennsylvania, Philadelphia, Penna.

A brief review will include a discussion of the etiology and pathology of silicosis. The comprehensive group of silicotic conditions will be illustrated by slides, and some of the conditions that simulate silicosis will be discussed.

Some of the more recent observations in the pathologic physiology of silicosis will be considered, as well as the difficulty in making the diagnosis of carcinoma of the lung in patients with silicosis.

Course No. 17: Wednesday, 8:30–10 A.M.

The Roentgen Anatomy of the Temporal Bone

OSCAR V. BATSON, M.D.
Graduate School of Medicine, University of Pennsylvania
Philadelphia, Penna.

Neither descriptive anatomy nor topographic anatomy gives the roentgenologist an adequate concept of the temporal bone. For roentgen anatomy the bone can be divided into two parts, a mural or brain-case portion and a petrous portion. This latter portion projects inward from the mural portion at an angle of 45 degrees. Orienting these parts in the skull makes clear at once that there are several possibilities of obtaining a roentgen film of one portion or the other. These possibilities are reduced by the interference of overlapping shadows of other structures. The numerous suggested views of the region tend to fall into two groups; those in which the central ray is approximately at right angles to the side of the skull; those in which the central ray is at right angles to the major axis of the petrous pyramid.

The fixed space relations of the several air cavities and the criteria for identification must be understood. For example, the antrum tympanicum is always on a level with the epitympanum but posterior to it and definitely lateral to it. Similar space relations are required for the labyrinth, such as the fact that the first turn of the cochlea is always the lowest part of the labyrinth and that the superior, *i.e.*, anterior, vertical semicircular canal is at right angles to the axis of the petrous portion of the bone.

The terms used by the otologic surgeon for the typical operations are confusing in that they are common English words but are used in a specific technical sense. So long as the posterior bony canal wall is intact, the operation is a "simple mastoidectomy," while the surgical removal of a small amount of bone, if it includes the posterior canal wall, is "radical mastoidectomy."

In the infant the bone can be readily separated into components. When this is done, a petrous antrum is displayed, as is also a squamous antrum. The cells which grow out from these may retain complete integrity and the bone separating the two complexes forms a true Koerner's septum. Even without a definite septum it is usual to find air cells of different character in the two parts. The secondarily developed mastoid process, so prominent in the adult, is formed partly from the pars squamosa and partly from the pars petrosa. The mastoid tip cells are always from the antrum of the pars petrosa.

The roentgenologist can give the surgeon much valuable information in addition to the diagnosis. He can definitely state the size and location of the air cells and the thickness of the cortical bone, and he alone can state accurately, before operation, the location and size of the sigmoid venous sinus. This location may well determine the operative approach.

The anomalies of development are easily classified in terms of the bone of the newborn. It is doubtful if a persistent petrosquamosal suture would today be mistaken for a fracture, but the location and peculiarities of this suture must be remembered

Structures which cast overlapping shadows are generally ignored until one of unusual size is encountered. To mention examples: the bone markings around the torcular may intrude into a Stenvers' projection; a dilated arteriosclerotic carotid artery may erode part of a petrous apex.

To illustrate and extend the above points Kodachrome slides of anatomic specimens will be used, as well as slides of roentgen films. The anatomic slides will show transparent bone preparations, sectioned and dissected bones, and a series of bones dissected to reveal the changes produced by surgery. A representative collection of anatomic specimens will be at hand to clarify points under discussion. Questions are invited.

REFRESHER COURSES

THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

December 7 through December 12, 1952

NETHERLAND-PLAZA AND SHERATON-GIBSON HOTELS

CINCINNATI, OHIO

(Detach here) SEE INSTRUCTIONS ON REVERSE SIDE

FILL OUT THE FOLLOWING

(Print or type) ..... M.D.
Last Name First Name or Initials

.....
Street Address

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City State

CHECK THE FOLLOWING

Member R.S.N.A. ☐ Member-elect R.S.N.A. ☐ Guest ☐

Resident or fellow in Radiology at present ☐ Where.....

Medical Student ☐ Where.....

Reserve Officer on Active Duty at present ☐ Allied Scientist ☐

Fill out, also, the enrollment diagram on the reverse side of this page

INSTRUCTIONS FOR ENROLLMENT

IN REFRESHER COURSES

Read the accompanying description of the courses and plan of presentation. Register early; the number admitted to each course will be limited by the seating capacity of the rooms. Reservations will be made in the order of the receipt of request. Courses 1 to 32 will be held at the Netherland-Plaza Hotel and courses 33 to 44 at the Sheraton-Gibson Hotel.

Courses are limited to the medical profession (M.D.'s), including graduate students and residents in Radiology and to allied scientists such as radiation physicists, radiobiologists, chemists, and others.

All tickets will be held for you at the Registration Desk at the Netherland-Plaza Hotel. This will be the only Registration Desk for all courses to be conducted in both hotels.

The registration fee, where applicable, will cover the cost of the Refresher Courses. Members, members-elect, guest speakers, guest instructors, residents or fellows in Radiology, medical students, members of the Armed Forces, and allied scientists do not pay a registration fee. Non-members not in these groups will pay a registration fee of $15.00 which will include the Refresher Courses.

PLEASE INDICATE YOUR FIRST, SECOND AND THIRD CHOICES

	First Choice		Second Choice		Third Choice	
	Course No.	Instructor	Course No.	Instructor	Course No.	Instructor
Sunday, Dec. 7 2:30 P.M.						
7 P.M.						
Monday, Dec. 8						
Tuesday, Dec. 9						
Wednesday, Dec. 10						
Thursday, Dec. 11						
Friday, Dec. 12						

Mail this order sheet to John W. Walker, M.D., Chairman, Refresher Course Committee
Prior to Dec. 1, 830 Argyle Bldg., Kansas City, Mo.
After Dec. 1, c/o Radiological Society of North America, Netherland-Plaza Hotel, Cincinnati, Ohio

Course No. 18: Wednesday, 8:30–10 A.M.

Fractures of the Extremities

THEODORE H. VINKE, M.D.

(Continued from Tuesday, Course No. 12)

Course No. 19: Wednesday, 8:30–10 A.M.

Examination of the Colon

HENRY C. CROZIER, M.D.

Queen of Angels Hospital, Los Angeles, Calif.

The material to be presented will be divided into three parts as follows:

Part 1: A detailed discussion of the preparation of the patient, apparatus employed, and the technic used in conventional studies and in the double-contrast studies of the colon.

Part 2: Roentgenograms demonstrating the pathological entities which may be discovered in the examination of the colon.

Part 3: Discussion of the importance of having a conventional and a double-contrast study of the colon as separate examinations.

Course No. 20: Wednesday, 8:30–10 A.M.

Roentgen Studies of the Small Bowel

PAUL C. SWENSON, M.D.

Jefferson Medical College, Philadelphia, Penna.

A general discussion of the roentgen findings in the small intestine as they are encountered in routine gastrointestinal work. Disorders of function as well as local and general organic change will be included: inflammatory conditions, neoplasms, diseases of the mesentery, etc.

Course No. 21: Thursday, 8:30–10 A.M.

Bone Lesions in Children

HARVEY WHITE, M.D.

Children's Memorial Hospital, Chicago, Ill.

Examples of bone lesions which are common, unusual, and peculiar to children will be shown and discussed. Congenital anomalies, neoplasms, infections, and metabolic disturbances will be covered.

Course No. 22: Thursday, 8:30–10 A.M.

The Roentgenologic Findings in Bone Diseases

I. SNAPPER, M.D.

Cook County Hospital, Chicago, Ill.

I. Hyperparathyroidism
II. Renal osteopathy with secondary hyperplasia of parathyroids
III. Paget's disease
IV. Polyostotic fibrous dysplasia
V. Rickets and osteomalacia
VI. Osteoporosis
VII. Multiple myeloma

(This course continued Friday, Course No. 28)

Course No. 23: Thursday, 8:30–10 A.M.

Radiation Therapy in Cancer of the Female Genital System

HOWARD B. HUNT, M.D.

Nebraska Methodist Hospital, Omaha, Neb.

Consideration will be given to the management of carcinoma of the cervix and body of the uterus, vagina, vulva, and ovaries, as modified by individual variations in anatomy, pathology, previous surgery, general health, stage of disease, and age of the patient. The relative advantages and indications for conventional external roentgen therapy, transvaginal irradiation, intracavitary and interstitial radium, and surgery will be reviewed. Management of recurrences and complications will be considered. Discussion is invited.

(This course continued Friday, Course No. 29)

Course No. 24: Thursday, 8:30–10 A.M.

The Roentgen Anatomy of the Paranasal Sinuses

OSCAR V. BATSON, M.D.

University of Pennsylvania, Philadelphia, Penna.

The roentgenologist and the rhinologist use different criteria in naming the paranasal sinuses. The roentgenologist names them on the basis of the location of the cells themselves; the rhinologist names them from the location of their ostia. With an understanding of this difference, no confusion should exist. The surgical anatomy of the sinuses is not so important as it was before recent advances in therapy. By this same token, the smaller number of cases requiring examination decreases the total experience of the examiner and makes essential a careful study of the principles of growth, variation, and relations of the paranasal sinuses.

Obtaining a satisfactory sinus film is largely a matter of displacing unwanted shadows. The chief obscurers are the two petrous bone shadows. In sinus examinations these shadows are generally thrown above or below the sinus area. Further difficulty is encountered because the sinus shadows themselves obscure each other.

The direction of extension of enlarging sinuses and the structures encountered must be considered. The roof of the orbit may be invaded by frontal, ethmoid, or sphenoid cells. The sphenoid sinus extends into the septum and into the wings of the sphenoid bone —even as far as the lateral wall of the orbit. The maxillary sinus may invade the tuberosity of the maxilla, and so on. The actual intimate relation of a

SUNDAY, Dec. 7 2:30–5 P.M.	MONDAY, Dec. 8 8:30–10 A.M.	TUESDAY, Dec. 9 8:30–10 A.M.
1. **Therapy Information—Problem Cases** Theodore P. Eberhard, M.D., Moderator Juan A. del Regato, M.D. Isadore Lampe, M.D. James F. Nolan, M.D. Franz J. Buschke, M.D. Ralph M. Caulk, M.D. John Hale, M.S.	3. **Lesions of the Chest in Infants and Children** John F. Holt, M.D.	9. **Radiological Diagnosis of Congenital Malformations of the Heart and Great Vessels** M. H. Wittenborg, M.D.
	4. **Pulmonary Physiology and Pulmonary Function Tests (Continued Tuesday)** Julius H. Comroe, Jr., M.D.	10. **Pulmonary Physiology and Pulmonary Function Tests (Continued from Monday)** Julius H. Comroe, Jr., M.D.
	5. **Treatment of Cancer of the Skin and Lip** Bernard P. Widmann, M.D.	11. **Carcinoma of the Male Genital System** Milton Friedman, M.D.
7–9 P.M.		
2. **Film Interpretation Session** L. Henry Garland, M.D., Moderator Paul C. Swenson, M.D. Leo G. Rigler, M.D. Earl R. Miller, M.D.	6. **The Anatomical Basis for Venographic Interpretation with New Developments in Methods of Venography** Davitt A. Felder, M.D.	12. **Fractures of the Extremities (Continued Wednesday)** Theodore H. Vinke, M.D.
	7. **Roentgen Diagnosis of the Arthropathies (Continued Tuesday)** A. A. deLorimier, M.D.	13. **Roentgen Diagnosis of the Arthropathies (Continued from Monday)** A. A. deLorimier, M.D.
	8. **Lesions of the Esophagus, Stomach and Duodenum (Continued Tuesday)** Cesare Gianturco, M.D.	14. **Lesions of the Esophagus, Stomach and Duodenum (Continued from Monday)** Cesare Gianturco, M.D.

COURSES IN

Refresher Courses in Allied Sciences to be held in the Sheraton-Gibson Hotel	33. **Basic Radiation Dosimetry** H. M. Parker
	34. **Design and Equipment of the Radioisotope Laboratories** George G. Manov
	35. **Radiation Effects at the Chemical Level** Ugo Fano

PRESENTATION

WEDNESDAY, Dec. 10 8:30–10 A.M.	THURSDAY, Dec. 11 8:30–10 A.M.	FRIDAY, Dec. 12 8:30–10 A.M.
15. **Anomalies of the Urinary Tract in Children** L. L. Klostermyer, M.D.	21. **Bone Lesions in Children** Harvey White, M.D.	27. **Cerebral Angiography** Earl R. Miller, M.D.
16. **Radiological Aspects of the Chest in Industry** Eugene P. Pendergrass, M.D.	22. **The Roentgenologic Findings in Bone Diseases (Continued Friday)** I. Snapper, M.D.	28. **The Roentgenologic Findings in Bone Diseases (Continued from Thursday)** I. Snapper, M.D.
17. **Roentgen Anatomy of the Temporal Bone** Oscar V. Batson, M.D.	23. **Radiation Therapy in Cancer of the Female Genital System (Continued Friday)** Howard B. Hunt, M.D.	29. **Radiation Therapy in Cancer of the Female Genital System (Continued from Thursday)** Howard B. Hunt, M.D.
18. **Fractures of the Extremities (Continued from Tuesday)** Theodore H. Vinke, M.D.	24. **The Roentgen Anatomy of the Paranasal Sinuses** Oscar V. Batson, M.D.	30. **Technic and Interpretation of Roentgen Examination of the Paranasal Sinuses** Barton R. Young, M.D.
19. **Examination of the Colon** Henry C. Crozier, M.D.	25. **Radium Therapy (Continued Friday)** John D. Reeves, M.D.	31. **Radium Therapy (Continued from Thursday)** John D. Reeves, M.D.
20. **Roentgen Studies of the Small Bowel** Paul C. Swenson, M.D.	26. **What the Chief Should Teach His Young Braves About the Economics of Radiology (Repeated Friday)** W. Edward Chamberlain, M.D.	32. **What the Chief Should Teach His Young Braves About the Economics of Radiology (Repeated)** W. Edward Chamberlain, M.D.

ALLIED SCIENCES

36. **Problems and Pitfalls in X-ray Calibrations and Protection Surveys** Carl B. Braestrup	39. **The Calculation of Dosage in Interstitial Radium and Other Radioisotope Therapy** Elizabeth F. Focht	42. **Special Technics to Improve Tissue Dose in the 200–250 Kv. Region** Edith H. Quimby
37. **Safe Handling of Radioactive Isotopes** Ralph Overman	40. **Useful Isotope Technics for Hospital Practice** John Hale Robert O. Gorson	41. **Radiation Dosage Planning and Recording** Gilbert H. Fletcher Robert J. Shalek
38. **Radiation Effects at the Cellular Level** Raymond E. Zirkle	41. **Radiobiology in Small Animals** Roberts Rugh	43. **Protective Agents Against Radiation Damage** Leon Jacobson

sinus to a vital structure, *e.g.* the sphenoid sinus to the optic nerve, is not considered as significant as it once was. It is, of course, extremely important to the surgeon, but we now know that the optic nerve can be involved from a distance by a retrograde thrombophlebitis. This has caused the anatomy of the veins to increase in importance. The veins about the paranasal sinuses are without valves and they do not have a constant direction of flow.

For demonstrating the above, slides of anatomic specimens will be shown along with roentgen films. Emphasis will be placed upon the peculiarities of sinus variations and upon unusual overlapping shadows. Specimens will be available for amplification and discussion.

Course No. 25: Thursday, 8:30–10 A.M.

Radium Therapy

JOHN D. REEVES, M.D.

Hospital of the University of Pennsylvania, Philadelphia

A review of fundamentals in the clinical use of radium. Surface, interstitial, and intracavitary applications will be considered. A variety of illustrative cases will be presented in brief detail with discussion of treatment and sample calculations of radium dosimetry; also, the advantages of other modalities (particularly 40 to 2,000-kv. x-ray, radon, and isotopes) where applicable.

(*This course continued Friday, Course No. 31*)

Course No. 26: Thursday 8:30–10 A.M.

What the Chief Should Teach His Young Braves About the Economics of Radiology

W. EDWARD CHAMBERLAIN, M.D.

Temple University Medical School and Hospital
Philadelphia, Penna.

Relationship of the radiologist to his patient: in private office practice; in a hospital department of radiology; factors that may affect such relationship (for example, the effect of having the radiologist's fee collected by the hospital).

Hospital-radiologist relationships: in respect to departmental administration (equation number one, "responsibility minus authority equals frustration"); in respect to the method by which the radiologist is compensated; why it is best for the radiologist to collect his own fees. Selected examples of what happens to the hospital radiologist under certain conditions. Exhibit of "impossible," bad, fair, and good and exceptionally good forms of contract, or working agreement, with examples. Exhibit of good and not-so-good bookkeeping methods.

Satisfactory hospital-radiologist relationships tend to bring top-notch radiologists into hospital practice; unsatisfactory arrangements tend to drive top-notch radiologists into private office practice, thus depriving hospital in-patients of their right to the best in medical care. Where unsatisfactory hospital-radiologist relationships exist, how much of the fault lies with the radiologist and how much with the hospital? How shall we answer the charge that "the hospital radiologist has a monopoly"?

How can the young radiologist establish himself in hospital practice on a fair and equitable basis? The advantages of being employed at the time one is negotiating with hospital management. The young man should stay in an "associateship" until he has developed the requisite stature and reputation to enable him to stand up to the hospital authorities with whom he is negotiating. The all-too-frequent error of accepting an unsatisfactory arrangement in the expectation of renegotiation "next year"; experience proves that the radiologist's only chance to get a proper contract is when he first starts.

The impact upon radiology of Blue Cross hospitalization insurance plans, the nefarious "all-inclusive, flat-rate" method of hospital billing, etc.

Course No. 27: Friday, 8:30–10 A.M

Cerebral Angiography

EARL R. MILLER, M.D.

University of California, School of Medicine
San Francisco, Calif.

The anatomy of the cerebrovascular system will be discussed. Various radiologic technics will be presented for carrying out cerebral angiographic studies. The course will consist mainly of the presentation of films demonstrating evidences of disease and anomalies commonly seen in angiographic practice.

Course No. 28: Friday, 8:30–10 A.M.

The Roentgenologic Findings in Bone Diseases

I. SNAPPER, M.D.

(*Continued from Thursday, Course No. 22*)

Course No. 29: Friday, 8:30–10 A.M.

Radiation Therapy in Cancer of the Female Genital System

HOWARD B. HUNT, M.D.

(*Continued from Thursday, Course No. 23*)

Course No. 30: Friday, 8:30–10 A.M.

Technic and Interpretation of Roentgen Examination of the Paranasal Sinuses

BARTON R. YOUNG, M.D.

Germantown and Temple University Hospitals
Philadelphia, Penna.

Opinions vary considerably as to what constitutes an adequate radiologic examination of the nasal

sinuses, and it must be understood that the technic advocated is only one of a number of methods of examination. Examination in the sitting position allows a demonstration of fluid levels in the sinuses and, therefore, all studies are done with the patient sitting unless illness necessitates utilization of the prone position. Stereoscopic views afford a more exact localization than a single view, and are obtained routinely. The Waters, Caldwell, and lateral views are basic requirements and are supplemented by special studies when indicated.

Lateral views reveal the size and shape of the frontal sinuses and the thickness of their anterior walls and thus aid in the evaluation of frontal sinus opacity. Valuable information concerning the other sinuses is also afforded by the lateral views. Often the turbinates, meati of the nose, the soft palate, pharyngeal opening of the eustachian tube, and adenoids are demonstrated by the lateral view.

Views in the Caldwell position frequently are valuable when dealing with frontal sinus disease, especially when there is a question of secondary involvement of the adjacent frontal bone. These views aid in the evaluation of ethmoid disease in some patients, especially when the ethmoids are well developed. A discussion of the open-mouth sphenoid views and the Granger position is also included.

The appearance of the sinuses in allergic states and in acute, subacute, and chronic infections will be discussed. The changes due to submucous cyst or polyp, mucocele, and benign and malignant tumors will be considered, and illustrations of these conditions will be included in the presentation. Disease in the maxillary sinus of dental origin is considered. Extension of chronic infection from the mucous membrane to the sinus wall effaces the boundary of the sinus and is entitled mucoperiostitis. The roentgen appearance of the sinuses in this condition and in osteitis, and osteomyelitis will be covered.

Course No. 31: Friday, 8:30–10 A.M.

Radium Therapy

JOHN D. REEVES, M.D.

(Continued from Thursday, Course No. 25)

Course No. 32: Friday 8:30–10 A.M.

What the Chief Should Teach His Young Braves About the Economics of Radiology

W. EDWARD CHAMBERLAIN, M.D.

(Repetition of Course No. 26)

COURSES IN ALLIED SCIENCES

Course No. 33: Tuesday, 8:30–10 A.M.

Basic Radiation Dosimetry

H. M. PARKER

Nucleonics Division, General Electric Company
Richland, Wash.

1. Influence of spatial and temporal distribution of ionizing events in tissue.
2. Energy absorption in tissue as the basis for dosimetry.
3. Direct measurement of energy absorption—calorimetry.
4. Indirect measurement of energy absorption—the Bragg-Gray Principle.
5. Relationship of the roentgen to this principle.
6. Extension of dosimetry to particulate radiation.
7. Use of the term "rep."
8. Dosimetry of radioisotope distributions in tissue—the "infinite mass" simplification.
9. Simple modifications of the infinite mass case.

Course No. 34: Tuesday, 8:30–10 A.M.

Design and Equipment of the Radioisotope Laboratories

GEORGE G. MANOV

A.E.C., Isotopes Division, Oak Ridge, Tenn.

The design and equipping of radioisotope hospital laboratories are presented from the point of view of the quantity of radioisotopes involved, the types of radiation emitted, the frequency of handling, and the number of patients.

Distinction is made between laboratories that plan to use radioisotopes for diagnostic or therapeutic purposes only (such as I^{131} and P^{32}, purchased in a standardized, packaged form) and those which plan to do considerable animal and biological experimentation. Scale models of typical laboratories will be exhibited.

Course No. 35: Tuesday, 8:30–10 A.M.

Radiation Effects at the Chemical Level

UGO FANO

National Bureau of Standards, Washington, D.C.

The mechanisms which distribute the action of high-energy radiations among the atoms and molecules of a material will be reviewed and discussed. Emphasis will be laid on the manner in which the radiation energy becomes available for the production of chemical changes.

Course No. 36: Wednesday, 8:30–10 A.M.

Problems and Pitfalls in X-Ray Calibrations and Protection Surveys

CARL B. BRAESTRUP

Delafield Hospital, New York, N. Y.

Discussion and demonstration of x-ray measurements of useful beam and stray radiation. Emphasis will be given to the common sources of errors in calibrating x-ray equipment, including limitations of the r-meter, improper measuring procedures, and defects in equipment.

Course No. 37: Wednesday, 8:30–10 A.M.

Safe Handling of Radioactive Isotopes

RALPH OVERMAN

Institute of Nuclear Studies, Oak Ridge, Tenn.

The procedures for carrying out experimental work with radioactive isotopes will be discussed, including manipulations of the quantities of radioactive materials required for therapeutic, diagnostic, and experimental work. Manipulations of the materials and evaluation of the results will be considered. Emphasis will be placed on new technics of handling and measurement.

Course No. 38: Wednesday, 8:30–10 A.M.

Radiation Effects at the Cellular Level

RAYMOND E. ZIRKLE

Institute of Radiobiology and Biophysics
University of Chicago, Chicago, Ill.

This course will stress recent investigations of radiation action on genes, chromosomes, and cell division, with special reference to modification of these actions by the following factors: (1) ion density produced by the radiations; (2) chemicals in the cell or its medium; (3) portion of cell irradiated. The course will be illustrated by lantern slides and by time-lapse motion pictures showing various types of mitotic aberrations in irradiated cells.

Course No. 39: Thursday, 8:30–10 A.M.

The Calculation of Dosage in Interstitial Radium and Other Radioisotope Therapy

ELIZABETH F. FOCHT

Memorial Center, New York, N. Y.

The principles and technics of dosage calculations in the use of discrete sources for intracavitary or interstitial therapy are similar for all gamma emitting isotopes. The fundamentals of distribution, amount, exposure, filter, and dose will be discussed for gamma-ray sources in general and then for particular variations of the more commonly employed elements such as radium, radon, cobalt, gold, etc.

Radiographic technics for determining spatial arrangement and gadgets for working out the dose in the case of non-rigid distributions will be reviewed.

Course No. 40: Thursday, 8:30–10 A.M.

Useful Isotope Technics for Hospital Practice

JOHN HALE and ROBERT O. GORSON

University of Pennsylvania Hospital
Philadelphia, Penna.

Instrumentation involved in the clinical use of isotopes will be considered from an elementary standpoint, especially in reference to isotope assay, patient counting, health safety, and some special problems.

Use of nuclear measurement instruments elsewhere in the radiology department will be considered.

Course No. 41: Thursday, 8:30–10 A.M.

Radiobiology in Small Animals

ROBERTS RUGH

College of Physicians and Surgeons, New York, N. Y.

After a brief introduction on the physical aspects of irradiation of laboratory animals, data will be presented on the lethal effects of total-body irradiation in different species and especially on the effects of total-body exposure to radiations of different specific ionization. This will be followed by a summary of the means available at present to modify acute and chronic irradiation injury by chemical (such as cysteine), physiological (such as anoxia), and biological procedures (such as spleen protection and bone-marrow injections), and their effects on life span. Survival curves will be given showing the dependence of survival on dose, species, and age, following acute and chronic total-body irradiation. The factors governing reduction in life span, especially chronic irradiation-induced anemia and carcinogenesis, will be taken up. The importance of the carcinogenic action of total-body irradiation will be emphasized, especially so far as systemic effects are involved. Finally, factors will be discussed influencing the radiosensitivity of experimental lymphoid tumors and the application of biological procedures in the modification of irradiation injury in the treatment of experimental leukemia.

Course No. 42: Friday, 8:30–10 A.M.

Special Technics to Improve Tissue Dose in the 200–250 Kv. Region

EDITH H. QUIMBY

College of Physicans and Surgeons, New York, N. Y.

In recent years two old technics have been revived and have received considerable attention: rotation therapy and therapy through a grid. In each case the aim is to deliver an adequate dose to deep-seated tissues while maintaining skin dose at a safe level. Physical bases for these procedures will be discussed. A third scheme, the flattening of

isodose curves by the use of special filters, will also be considered.

Course No. 43: Friday, 8:30–10 A.M.

Radiation Dosage Planning and Recording

GILBERT H. FLETCHER and ROBERT J. SHALEK
Anderson Hospital, Houston, Texas

A system of recording has to develop around the clinical work-up, planning, and dosimetry. Cases of x-ray and radium therapy will serve to demonstrate the step-wise building of a complete record from the original examination to the summary. Forms from various institutions will be discussed.

The validity of dosimetric calculations and the need of supplemental direct measurements in some types of cases will be considered.

Course No. 44: Friday, 8:30–10 A.M.

Protective Agents Against Radiation Damage

LEON O. JACOBSON
University of Chicago Clinic, Chicago, Ill.

Data are available which conclusively show that survival of laboratory animals exposed to a single lethal dose of total-body x-radiation can be significantly increased by measures instituted before or after the radiation injury has been sustained. Evidence is also available that the injury produced by repeated or chronic exposure to radiation can also be favorably influenced. The effective prophylactic measures include the administration of such materials as estrogens, cysteine, or glutathione. "Therapeutic" measures, or, more correctly, measures instituted after irradiation injury, include spleen-shielding, intraperitoneal implantation of splenic tissue, intraperitoneal implantation of embryo suspensions, intravenous or intraperitoneal injection of homologous bone marrow suspensions and related technics. Recent evidence indicates that heterologous tissue (splenic or bone marrow) is also effective. Although the mechanisms of action of these "prophylactic" and "therapeutic" agents or measures are not known, present evidence tends to indicate that they are different and possibly unrelated.

Discussion of the use of antibiotics, of blood and blood substitutes, which are undoubtedly important in the treatment of radiation injury, will be separated out from the discussion of "prophylactic" and "therapeutic" measures referred to above in order to emphasize the broad approach which is being taken in the investigation of the problem.

The Refresher Course Committee gratefully acknowledges the work of Dr. Edith H. Quimby in formulating the Courses in the Allied Sciences.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., 635 Herkimer St., Pasadena 1, Calif.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 15 East Monroe, Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Calvin L. Stewart, M.D., 2330 First Ave., San Diego.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, John B. Hamilton, M.D., 210 N. Central Ave., Glendale 3. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, G. A. Fricker, Sacramento Co. Hospital, Sacramento 17. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, Rex Uncapher, M.D., 7720 Girard Ave., La Jolla. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly, at the University Club.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, Ford Shepherd, M.D., 526 Soquel Ave., Santa Cruz. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Charles E. Duisenberg, M.D., Palo Alto Clinic, 300 Homer Ave., Palo Alto. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Wendell P. Stampfli, M.D., 1933 Pearl St., Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, William A. Goodrich, M.D., 85 Jefferson St., Hartford 14. Meets bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, B. Bruce Alicandri, M.D., 20 Maple St., Springfield, Mass. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, U. V. Wilcox, M.D., 915 19th St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. Judson Graves, M.D., 2002 Park St., Jacksonville. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, Maurice Greenfield, M.D., Ingraham Bldg., Miami. Meets monthly, third Wednesday, 8:00 P.M., Veterans Administration Bldg., Miami.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Rayle, Jr., M.D., 478 Peachtree St. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert M. Tankesley, M.D., 218 Doctors Bldg., Atlanta. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary*, Col. Alexander O. Haff, Tripler Army Hospital, Honolulu. Meets monthly on the third Friday, at Tripler Army Hospital.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Elbert K. Lewis, M.D., 6337 S. Harvard Ave., Chicago 21. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, John A. Robb, M.D., 23 East Ohio St., Indianapolis. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*. James McMillen, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and holds a scientific session in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Charles M. White, M.D., 3244 East Douglas, Wichita 8. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston. Meets three times a year—Spring, Summer, and Fall.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, H. Leonard Warres, 2337 Eutaw Place, Baltimore 17. Meets third Tuesday, September to May.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 621 High St., Jackson 2, Miss. Meets monthly, third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Sidney Rubin, M.D., 410 Professional Bldg., Kansas City, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Francis O. Trotter, Jr., M.D., 634 North Grand Blvd., St. Louis 3. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Russell W. Blanchard, M.D., 1216 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Stanley M. Wyman, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Nicholas G. Demy, M.D., 912 Prospect Ave., Plainfield. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 8:45 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Joseph J. La Vine, M.D., 259 North Grand Avenue, Baldwin, N.Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Harold W. Jacox, 622 W. 168th St., New York 32.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John F. Roach, M.D., Albany Hospital, Albany. Meets at University Club, Albany, second Wednesday, October, November, and March. Annual meeting in June.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Robert J. Bloor, 260 Crittenden Blvd. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary*, Walter J. Brown, M.D., Northern Westchester Hospital, Mount Kisco, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, Waldemar C. A. Sternbergh, 1400 Scott Ave., Charlotte 2. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Milton Berg, M.D., Quain & Ramstad Clinic, Bismarck. Meets in the Spring with State Medical Association and in the Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Willis S. Peck, M.D., 1838 Parkwood Ave., Toledo 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Harry K. Hines, M.D., 2508 Auburn Ave., Cincinnati 19. Meets first Monday of each month, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Geo. A. Nicoll, M.D., Miami Valley Hospital, Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Danstrom, M.D., Medical Arts Bldg., Oklahoma City.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Richard Raines, M.D., Medical-Dental Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., American Oncologic Hospital, Philadelphia 4. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Donald H. Rice, M.D., West Penn Hospital, Pittsburgh 24. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., 1037 Stuart Bldg., Lincoln, Nebr.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Henry E. Plenge, M.D., Spartanburg General Hospital, Spartanburg. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, John E. Whiteleather, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., Newell Hospital, Chattanooga 2. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, Claude Williams, M.D., Fort Worth. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Frank M. Windrow, M.D., 1205 Hermann Professional Bldg.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Building, San Antonio 5, Texas. Meets at Brook Army Medical Center, the first Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Jan. 23–24, 1953, San Antonio.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John N. Burkey, M.D., 555 Medical-Dental Bldg., Seattle. Meets fourth Monday, September through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club.

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Irving I. Cowan, M.D., 425 East Wisconsin Ave., Milwaukee 2.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, Jean Bouchard, M.D. Assoc. Hon. Secretary-Treasurer, D. L. McRae, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 26, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, Mexico, D.F. Meets first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No 86, Panama, R. de P.

PUERTO RICO

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542 Santurce, Puerto Rico.

ABSTRACTS OF CURRENT LITERATURE

GENERAL RADIOLOGIC PRACTICE AND RESEARCH

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Digestive System

RADIOTHERAPY

RADIOISOTOPES

RADIATION EFFECTS; PROTECTION

GENERAL RADIOLOGIC PRACTICE AND RESEARCH

General Practice of Radiology. Joshua C. Dickinson. J. A. M. A. **147:** 709–711, Oct. 20, 1951.

In the Chairman's address before the Section on Radiology at the One-Hundredth Session of the American Medical Association, June 13, 1951, the author discusses some of the problems of general radiology based on a point of view influenced by thirty years devoted to the private practice of clinical radiology.

To be a medical consultant in the fullest sense, the radiologist must be sufficiently interested and have sufficient time to take a history, make a physical examination, and display a real interest in the patient and the problem presented. The radiologist must try in every way at his disposal to be of constructive help in the handling of a given medical problem.

The author believes that radiology will contribute more to medicine and be of greater service by a continuation of the practice of general radiology than by a division of the specialty into separate fields of diagnosis and therapy.

In the desire to turn out doctors highly trained in the science of radiology, all too often the art of clinical medicine is neglected. Residents must have the opportunity to develop the patient point of view.

It is held that the practice of radiology will be best safeguarded in the future if radiologists conduct their practice in private offices rather than in hospitals. Certain fields of radiology are distinctly hospital procedures, but in the main the specialty can be practised just as satisfactorily, if not more so, in private offices. The encroachment of the hospital in the field of the practice of medicine, the author believes, is more of a real threat to the radiology of the future and to all medicine than any plan of compulsory health insurance yet proposed.

A newly certified diplomate should not be looked on as a fully competent consultant in a specialty. Certification means that basic requirements have been fulfilled and certain tests have been passed, qualifying one to go out and learn to practice his specialty as it applies to the general field of medicine. Every diplomate should have a sound basic training in general radiology before devoting his time to a limited field in therapy or diagnosis.

If radiology is to remain a field that will attract well trained capable physicians who are interested in clinical medicine, over-specialization within the ranks of radiologists must be curbed and the proper patient-physician relationship must be maintained.

J. Franklin Walker, M.D.
VA Hospital, Chamblee, Ga.

Our Research Responsibilities. Ralston Paterson. Proc. Roy. Soc. Med. **44:** 894–898, October 1951.

In a presidential address before the Royal Society of Medicine, the author defines research as "planned investigation based on a critical attitude to present conceptions of diagnosis, or treatment, and applied to determining the true scope and most effective application of new knowledge, or to arriving at measurement of causes or effects." In the field of radiology he believes there are three main types of research, namely: true laboratory research, research involving the development of instruments or processes, and clinical research.

A good part of the address is devoted to discussion of clinical research. The comment is made that there is closer correlation of small laboratory projects with clinical investigations in the United States than in Great Britain.

The author emphasizes alternative treatment experiments. He believes that many such experiments can be done on man with adequate controls. As an example he mentions a study of the effects of treatment by two different methods, warning, however, that no experiment of this kind can be conducted on man except where the known results of both methods are such that no one concerned can have any twinges of conscience about prescribing either.

He does not believe that enough research, especially clinical research, is being done in Great Britain and points out that the expenditure for research does not exceed 1 per cent of the expenditure in the National Health Service.

W. L. Bridges, M.D.
Indiana University

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Experimental Evaluation of Cerebral Angiography. Grafton A. Smith, Carrel M. Caudill, George E. Moore, William T. Peyton, and Lyle A. French. J. Neurosurg. **8:** 556–563, November 1951.

An experimental study on rabbits was carried out to determine the effect of Diodrast carotid angiography on the cerebral vascular permeability (the so-called "blood-brain-barrier") as determined by the dyes trypan blue, disulfine blue, sodium fluorescein, and radioactive diiodofluorescein.

It was shown that 70 per cent Diodrast usually produces destruction of the blood-brain-barrier accompanied by such phenomena as convulsions and marked depression of respiration, blood pressure, and pulse. A 35 per cent solution of Diodrast proved to be much less toxic in this respect. The Diodrast injection pressure was regulated so that it did not exceed the arterial pressure.

The most significant finding in these studies was the failure to break the blood-brain-barrier with two of the five batches of Diodrast used, indicating that different batches of the same contrast medium from the same manufacturer vary widely in toxicity. It was suggested that the technic outlined might be used to screen out the more toxic batches.

Observations on the duration of the altered permeability showed it to be very transient—less than three hours. This correlates with the duration of recorded instances of transient hemiplegias in clinical Diodrast angiography.

Four patients were injected with measured amounts of radioactive diiodofluorescein and were examined with a shielded Geiger-Müller counter in routine manner for the localization of brain tumors. Twenty-four hours or

longer after this examination, unilateral percutaneous carotid angiography was performed with 35 per cent Diodrast. A second dosage of radioactive diiodofluorescein was then injected and another counting made in an identical manner. This revealed a definite increase in the externally measured radioactivity of the head, although there was no definite laterality to this increase. Indeed, only one patient had a tendency to a lateralization on the side of the angiogram. In one the situation was just the reverse.

The best explanation of the increased radioactivity following angiography in man is an increased vascular permeability, such as has been established in the experimental animal, and the same phenomenon in severe degree could account for the convulsions and transient hemiplegias seen clinically. It could account, also, for deaths in patients, especially those tumor victims who have edema, with an already established alteration in permeability.

HOWARD L. STEINBACH, M.D.
University of California

Experimental Evaluation of Certain Contrast Media Used for Cerebral Angiography: Electroencephalographic and Histopathological Correlations. Byron M. Bloor, Frank R. Wrenn, Jr., and George Margolis. J. Neurosurg. **8:** 585–594, November 1951.

This report presents results of the application of a method of study, previously described (J. Neurosurg. **8:** 435, 1951. Abst. in Radiology **58:** 754, 1952), combining the dye indicator technic with concomitant electroencephalography in the evaluation of some common contrast media and their non-iodinated homologues.

The substances tested fell into several chemical groups. Pyridine derivatives were represented by Diodrast, in 35 per cent, 50 per cent, and 70 per cent solutions, and Neo-iopax. In lieu of non-iodinated homologues of these compounds, N-methyl nicotinamide hydrochloride, a pyridine derivative and a normal body metabolite, was used. This was administered in a 20 per cent solution. The benzene derivatives were: Urokon in 30 per cent solution at both pH 5.4 and 7; its non-iodinated homologue, prepared in 20 per cent solution and adjusted to pH 7.4; and para-aminohippurate in 20 per cent solution. The studies were made on rabbits.

The electroencepahlographic abnormalities paralleled the findings by the dye indicator technic and the pathologic changes. All of the contrast media and their non-iodinated chemical homologues were capable of producing severe abnormalities in cerebral electro-activity and vascular permeability. The severity of injury varied directly with the amount and concentration administered. A larger amount of contrast medium was tolerated when it was administered in smaller increments. The longer the elapsed time between increments, the greater the tolerance.

It appeared that the vascular damage caused by the contrast medium could be reduced by carbon dioxide administration.

Of the media tested, Diodrast was the least noxious. The histologic findings suggested a selective toxic action of these agents upon the cerebral vascular bed with (1) early vasodilatation or loss of tone, (2) severe alteration in the permeability of the vessels, and (3) progressive cerebral edema consequent upon these changes.

Three photomicrographs; 4 tables.

HOWARD L. STEINBACH, M.D.
University of California

Angiographic Diagnosis of Spontaneous Thrombosis of the Internal and Common Carotid Arteries. Herbert C. Johnson and A. Earl Walker. J. Neurosurg. **8:** 631–659, November 1951.

Six cases of spontaneous thrombosis of the internal carotid artery diagnosed by cerebral angiography are described. One hundred and one similar cases were found in the literature.

Symptomatology: Headache was prominent in at least half of the cases, frequently preceding any other symptom for some period of time. Some degree of muscular weakness was found in 80 per cent of the cases. Speech disturbances were present in 60 per cent. Approximately 20 per cent of the patients experienced paresthesias in the paralyzed extremities, 20 per cent had convulsive attacks, and 15 per cent mental disturbances, usually severe, consisting of depression with marked deterioration.

Five patients complained of episodes of transient blindness, and in 11 there was optic atrophy with visual loss. Homonymous hemianopsia was present in 12 cases; diplopia was found in only 6. Ptosis occurred in 6 cases. Two patients had papilledema. In 1 patient the ipsilateral pupil was fixed. In 3 it was larger, but in 10 it was smaller.

Clinical Course: The onset of the illness was sudden in about 35 per cent of the patients. A slowly progressive course occurred in 25 per cent, with headaches, sporadic convulsive attacks, paresthesias and weakness, and some degree of mental regression and speech impairment. There was a history of transient attacks of headache, hemiparesis, paresthesias, and aphasia in the remaining 40 per cent of the series.

Incidence: Eighty-seven of the patients were males. There appeared to be a definite predilection for the thirty-to-sixty-year age group. In 65 per cent of the cases, the thrombosis occurred on the left side.

Angiographic Findings: In 6 of the 107 cases, the common, external, and internal carotid arteries were found to be thrombosed on one side when they were exposed. In 2 cases there was bilateral occlusion of the common carotid, and in 2 cases bilateral occlusion of the internal carotid. In the remaining 97 cases, the thrombosis involved only the internal carotid artery. In these instances, the radiopaque dye filled only the external carotid vessels, which frequently seemed to be dilated.

The internal carotid was found to be occluded at one of two sites, either within several centimeters of the bifurcation or at the carotid siphon. An arteriographic characteristic is the filling of the anterior communicating and anterior cerebral arteries of the occluded side by angiography performed on the normal side,

Ventriculography or *pneumoencephalography* was performed in almost half the cases and almost uniformly demonstrated dilatation of the ventricles, but frequently more on the side of the thrombosis.

Etiology: The two most common etiologic factors appeared to be arteriosclerosis and thrombo-angiitis obliterans.

Prognosis: Once the diagnosis has been made, the outlook for improvement is not particularly hopeful. Only about 25 per cent of the patients showed any improvement with or without treatment.

Six roentgenograms; 2 tables, 1 of which summarizes the previously reported cases.

HOWARD L. STEINBACH, M. D.
University of California

Arteriographic Demonstration of Spasm of the Intracranial Arteries, with Special Reference to Saccular Arterial Aneurisms. Arthur Ecker and Paul A. Riemenschneider. J. Neurosurg. **8:** 660–667, November 1951.

Among about 400 groups of angiograms made on 350 patients, the authors found only 12 instances which (in 10 cases) met their criteria of arteriographically demonstrated spasm of the intracranial arteries. Arterial spasm was diagnosed when a vessel was of larger caliber in a subsequent angiogram than was demonstrated at a previous study made under identical conditions. This study was concerned with spasm of moderate degree rather than with maximal spasm or total occlusion of the vessel, which obviously cannot be recognized arteriographically. Minimal spasm with alterations in caliber of less than 0.5 mm. were not considered because of the difficulties involved in precise measurements. The affected vessels were the internal carotid, anterior cerebral, and middle cerebral arteries and their branches.

Seven examples of spasm occurred in 6 cases of saccular arterial aneurysm of or near the circle of Willis. These were selected from a group of 29 cases of recently ruptured aneurysm. Arteriograms made twenty-three days or less after a subarachnoid hemorrhage from such an aneurysm generally revealed spasm; those made twenty-six days or more after a subarachnoid hemorrhage revealed none.

Other instances of spasm were associated with total or partial ligation of the carotid artery in the neck, postoperative astrocytoma, localized intracerebral hemorrhage and edema, and severe intrinsic disease of the arteries.

The spasm appeared in all cases to be due to traction on the arterial wall. Usually the spasm was maximal at the lesion but extended several centimeters along adjacent arteries in lesser degree.

Twenty-four roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Gasometric Studies in Carotid-Internal Jugular Anastomosis in the Neck. Preliminary Report on Human Experiences. Elisha S. Gurdjian, John E. Webster, and Francis Martin. Arch. Surg. **63:** 466–476, October 1951.

Anastomosis between the cervical carotid artery and internal jugular vein as a means of revascularizing the brain has been championed by Beck, McKhann and Belnap (J. Pediat. **35:** 317, 1949). Earlier work by the authors (J. Neurosurg. **7:** 467, 1950. Abst. in Radiology **57:** 592, 1951), on the Rhesus monkey, revealed that such anastomosis does not result in increase in the oxygen content of the superior sagittal sinus blood, but, on the contrary, that the oxygen content of the superior sagittal sinus blood may actually be lower after the shunt. The blood could usually be shown, by angiography, to course up one jugular vein to the lateral sinus, across to the opposite lateral sinus, and down the contralateral jugular vein, or else through the tributaries in the neck to the opposite jugular vein.

Feeling that careful gasometric studies in human beings were indicated in order to evaluate conflicting opinions and also to correlate experimental observations and findings in man, the authors undertook a study of 5 patients with cervical arteriovenous shunt, with the following results:

1. Gasometric studies of the sagittal sinus blood before and after cervical arteriovenous shunts revealed that the oxygen content of the sagittal sinus blood is not increased following the shunting procedure.

2. There appeared to be a change in the electroencephalographic pattern following the shunting procedure. This change was variable and non-specific.

3. Angiographic studies following cervical carotid artery-internal jugular vein anastomosis revealed results essentially similar to those obtained in the monkey. The blood goes up the jugular vein on the same side, into the lateral sinus, thence to the lateral sinus on the opposite side, and down the contralateral jugular vein into the neck. Many of the neck tributaries may also transport the blood from one side of the neck to the opposite side.

4. Choked disks and proptosis may result from increased blood flow through the lateral sinuses as well as through the venous sinuses at the base, engorging the cavernous-sinus neighborhood and thus preventing the normal venous flow from the orbits.

Seven roentgenograms; 5 electroencephalograms; 3 graphs; 2 tables.

HARRY HAUSER, M.D.
Cleveland City Hospital

Value of Ventriculo-Encephalography in Planning Roentgen Therapy for Brain Tumors. Eugene P. Pendergrass and John M. Phillips. Am. J. Roentgenol. **66:** 603–611, October 1951.

Combined ventriculo-encephalography is recommended as the method likely to provide more accurate information regarding intracranial tumors than any other at the disposal of the radiotherapist. Air is introduced simultaneously into the ventricles through trephine openings and into the subarachnoid space by lumbar puncture. In the light of past experience increased intracranial pressure is no contraindication to the procedure.

Anteroposterior, postero-anterior, and lateral roentgenograms are obtained in erect and horizontal positions. Brow-up and brow-down views are important when the horizontal beam is employed. Comparison of studies in these positions allows adequate demonstration of most tumors, as well as the extent of brain damage when present. When roentgen therapy is contemplated, the size and position of tumors may be more accurately shown, allowing the use of smaller portals and more effective irradiation of the lesion. Lesser amounts of normal brain tissue and bone are consequently subjected to large doses of radiation.

The authors recommend this method in every case prior to roentgen therapy. A base line for evaluation of tumor changes may thereby be established and a more accurate appraisal of roentgen therapy in brain tumors can be expected.

Five cases are presented, with 19 roentgenograms clearly demonstrating the tumors and the changes produced by them.

D. E. VIVIAN, M.D.
Indiana University

Diagnosis of Carcinoma of the Pituitary Gland. Arthur B. King. Bull. Johns Hopkins Hosp. **89:** 339–353, November 1951.

Despite considerable work done on the classification of the pituitary neoplasms, there is still no definite agreement as to what constitutes a carcinoma of the pituitary gland. If the sole criterion is the presence of metastases, then carcinomata of the pituitary are ex-

traordinarily rare. A case of neoplasm of the pituitary, which the author believes to be a carcinoma, is presented. In his opinion the widespread invasion by the tumor with disregard for the usual anatomical barriers, the absence of any capsule, the histologic picture of the individual cells, and the rapid progression of symptoms make the diagnosis inescapable, even though metastasis was lacking.

The patient was a 70-year-old woman, in whom facial pain was the predominant symptom. Physical examination showed nothing abnormal except for a blood pressure of 180/90 and a mild arteriosclerosis. Only the positive neurological findings will be mentioned. There was anosmia on the right; vision was absent in the right eye; and the right pupil failed to respond to light, both directly and consensually. Definite ptosis of the right lid was present, and almost complete impairment of movement of the right globe, both upward and inward, though downward movement was still preserved. A definite diminution of touch and pain over the right side of the face was found. The corneal reflex was absent on the right. Function of the right masseter and temporal muscles was impaired, with some atrophy.

Roentgenograms of the skull revealed striking changes about the sella turcica. There was almost complete destruction of the posterior clinoids. The limits of the sella were ill defined, with an almost complete loss of the floor. The anterior clinoid on the right had disappeared. The floor of the right middle fossa was less radiopaque than that on the left, suggesting destruction of the bone. There was a soft-tissue mass in the sphenoid sinus and in the right ethmoid sinus. It was also thought that there might be a soft-tissue mass in the nasopharynx, although none had been detected on careful inspection. A right carotid arteriogram was done by the percutaneous method. The right middle cerebral artery was depressed near its origin from the carotid. The intracranial portion of the carotid artery appeared lifted upward and tilted backward. There was no gross displacement, however, and the findings were minimal.

The patient died seven days after a right craniotomy. Postmortem examination revealed that only a small portion of the tumor had been removed. Microscopic sections of the neoplasm, both from operation and autopsy, showed a cancer that readily invaded bone, mucous membrane, and nerves.

The author concludes that the presence of facial pain, along with clinical and x-ray evidence of a pituitary tumor, strongly suggests a carcinoma. This is especially true when the pain is an early manifestation, since a benign adenoma usually extends in directions other than through the cavernous sinus, while a highly invasive neoplasm may reach the fifth nerve by destruction and penetration of the surrounding structures, exerting less pressure on the other cranial nerves to cause loss of function.

Eight illustrations, including 2 roentgenograms.

Asphyxial Attacks in the Newborn Infant Due to Congenital Occlusion of the Posterior Nares. Report of Five Cases. Harry Medovy and I. H. Beckman. Pediatrics **8**: 678–683, November 1951.

Five cases of congenital occlusion of the posterior nares are reported to draw attention to this condition as a possible cause of respiratory distress in the newborn infant and to stress the necessity for a careful examination of the choanal passages in all cases of neo-natal asphyxia. The diagnosis may be made by observation of the infant during feeding, by inability to pass a catheter or probe through the nares into the nasopharynx, and by roentgenographic studies with Lipiodol in the nasal passages.

Treatment is surgical and may be carried out successfully in early infancy if the condition is bilateral. Treatment of unilateral cases may be deferred to later childhood.

[Two cases of bilateral atresia of the posterior choanae were reported by Whitehouse and Holt in Radiology **59**: 216, August 1952.—Ed.]

Two roentgenograms.

Spontaneous Intramaxillary Hemorrhage. Charles H. LaClair, Jr. Arch. Otolaryng. **54**: 510–517, November 1951.

Six cases of intramaxillary hemorrhage, entirely "spontaneous" in origin, are added to the 23 previously recorded in the literature. Spontaneous intramaxillary hemorrhage may occur as a complication of chronic hyperplastic maxillary sinusitis. It can be associated also with changes of the lining membrane secondary to dental inflammatory disease. Hemorrhage from the maxillary sinus subsequent to dental manipulations should not be considered "spontaneous."

It is possible to demonstrate positively that the hemorrhage originates within the maxillary sinus by competently examining the entire interior of the nose and finding no bleeding site other than in the region of normal ostium; this is further confirmed to be the only site by the obtaining of old clotted blood on puncture and lavage of the sinus.

X-ray studies of the sinuses with a contrast medium should be carried out in every case of intramaxillary hemorrhage. If an abnormal lining membrane is revealed, a Caldwell-Luc operation should be performed to remove the site of bleeding.

In 5 of the 6 cases reported, roentgenograms of the sinuses showed evidence of thickened, hypertrophied membrane or a diffuse haziness overlying the involved sinus. Puncture and lavage of the maxillary sinus were performed in each of the patients and old blood in clots was obtained in all. The irrigation was followed immediately by the instillation of iodized oil and the sinuses were re-examined roentgenologically. In 4 of the patients a hypertrophied, irregular lining was demonstrated and in 1 patient a solitary polyp was also seen. In 2 cases the membrane appeared normal and no filling defect was visible.

Four of the patients were operated upon. In each instance, a hyperplastic polypoid membrane, varying in thickness from one-fourth to one-half inch, was found. The solitary polyp proved to be located at the site indicated by the iodized oil. In only 1 patient was the bleeding point thought to be seen.

Twelve roentgenograms.

Calcified Cervical Node Masquerading as Foreign Body. E. C. Manning. Arch. Otolaryng. **54**: 550–552, November 1951.

A calcified cervical lymph node is a frequent enough finding that a roentgenologist, seeing one on a film of the neck, may seem surprised that an otolaryngologist does not recognize it immediately. A case is presented in which a calcified cervical node in a patient who gave a history of swallowing a bone was mistaken for a for-

eign body in the esophagus and in the trachea. An anteroposterior roentgenogram showed an object resembling a bone. On esophagoscopy, a whitish area was seen in the cricopharyngeal region and an attempt was made to grasp it, but nothing was brought out with the forceps. Films taken two days later showed what appeared to be a foreign body in the trachea opposite the first thoracic vertebra. It was believed that the foreign body had probably been grasped and had then slipped from the forceps into the larynx and into the trachea. No foreign body was found on bronchoscopy. Lateral and oblique roentgenograms were then taken, and in the oblique view it could be seen that the object was in front of the trachea.

Three roentgenograms.

Radiological Diagnosis of Salivary Gland Disease. R. G. W. Ollerenshaw and S. S. Rose. Brit. J. Radiol. **24**: 538–548, October, 1951.

Sialography is a helpful adjunct in the diagnosis of diseases of the salivary glands. It is particularly useful in study of the parotid glands, as the submandibular glands offer fewer diagnostic problems. The sublingual glands and ducts are of little radiologic interest.

Iodized oil is the best medium, as watery solutions tend to run out of the gland too rapidly. Oblique views are taken for the submandibular glands and anteroposterior and lateral for the parotid. The gland should be filled into the acini if possible, otherwise the diagnosis is incomplete. At least 2 ml. of medium is required.

Simple duct obstruction presents no difficulties in diagnosis. Calculi are rare in the parotid system. *Non-obstructive recurrent parotitis* shows a normal duct system with terminal sialangiectasis. In early cases there will be a fair degree of filling of the acini, but in later cases very little. Acute cases are not suitable for sialography. *Obstructive recurrent parotitis* shows papillary or buccal duct stenosis with dilatation of smaller ducts behind the stricture. *Tumors* are recognized by the displacement of normal structures and inadequate filling.

Nineteen roentgenograms; 2 photographs; 1 drawing; 1 table. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Hypothyroidism Following Thyroidectomy for Congenital Obstructive Goiter. Nathan Schifrin and Elliott S. Hurwitt. J. Pediat. **39**: 597–605, November 1951.

A case of congenital obstructive goiter with surgically induced hypothyroidism in a 5-week-old child is described. At birth three lumps were noted in the infant's neck. During the first week, there was difficulty in swallowing, with several choking episodes. Gurgling sounds in the throat were heard. There was no family history of thyroid disturbance.

Roentgenograms of the neck showed rounded masses bulging from both sides of the neck, displacing the esophagus and trachea anteriorly. There was no intrathoracic extension of the masses.

A thyroidectomy was performed, after which signs and symptoms of hypothyroidism developed. This was controlled by the administration of thyroid.

Three roentgenograms; 2 photographs; 2 photomicrographs; 1 table.

HOWARD L. STEINBACH, M.D.
University of California

THE CHEST

Angiopulmography. Preben Thestrup Andersen, Ib Andersen, Helge Eltorm, Thue Poulsen, E. Glistrup, and Hilda Petersen. Acta radiol. **36**: 257–269, October 1951.

Now that angiocardiography has been accepted as an important diagnostic aid and its use has become increasingly widespread, this report calls attention to further important usage to which the procedure may be applied. Advances in thoracic surgery make ever increasing demands on intrathoracic diagnosis. The utilization of angiopulmography can assist in giving a more complete study of tumors, vascular anomalies, and infections.

The authors have used 30 to 100 c.c. of a 70 per cent concentration of Diodone intravenously, with the patient under general anesthesia. Of 20 patients, one exhibited edema of the eyelids and generalized itching and nearly all had severe attacks of coughing immediately following completion of the injection. No other abnormal reactions were noted. The radiographic apparatus permitted 8 to 10 exposures in a period of ten to fifteen seconds.

Eleven cases in which the procedure was undertaken are presented. Accompanying roentgenograms show the changes which may occur in the mediastinal and parenchymal vascular structures. Central tumors of the upper lobes result in displacement, compression, or occlusion of the pulmonary artery and, in cases of increased expansion, changes in the superior vena cava in the form of compression or invasion of the vessel. Complete or partial occlusion of the pulmonary vessels manifests itself in the form of reduced filling on the affected side, whereas the vessels on the unaffected side show accumulation of the opaque medium. In two instances, angiopulmography was the only diagnostic procedure which demonstrated inoperability. Owing to the intimate relation to the superior vena cava, tumors of the right upper lobe are the most satisfactory for this examination, but the authors believe that by a suitable technic it ought to be possible to visualize aortic defects resulting from invasion on the left side. In cases of peripheral tumors, it is considerably more difficult to interpret the angiopulmographic appearances; in one instance, however, peripheral vascular changes were observed, with reduced flow through the tumor and increased vascularization in its peripheral areas. Angiopulmography failed to afford any diagnostic aid in tuberculosis and bronchial asthma.

Seven roentgenograms. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Roentgenological and Pathological Observations in Antigenic Pneumonitis: Its Relationship to the Collagen Diseases. L. R. Sante and J. P. Wyatt. Am. J. Roentgenol. **66**: 527–544, October 1951.

The authors present a roentgenologic-pathologic correlation of the collagen diseases, using the observed roentgen changes in the lung fields as a mirror reflecting the pathologic process in the body.

The autopsy findings in the lungs are remarkably constant in all the collagen diseases. The lungs show septal thickening, hyaline membrane formation, and mononuclear infiltration in all acute phases. Fibroblastic proliferation, in addition to the above, is present in the more chronic forms, resulting in large amounts of collagenic scar.

The roentgen picture of the lungs varies somewhat with the type of collagen disease present. In general, however, the findings fall into one of two major groups:

(A) Cases in which there is an acute antigenic response, in the form of "azotemic" pulmonary edema. Here there is rapid development of blotchy and/or linear areas of increased density confined to the hilar regions and inner zones bilaterally. These shadows radiate peripherally but do *not* extend into the outer zone or appear most dense at the bases. The picture thereby differs from the usual pulmonary edema associated with cardiac failure. The "collagen diseases" presenting such lung findings are those in which acute glomerulonephritis is a factor. The authors include, as examples, drug sensitization reactions (both anaphylactoid and delayed types), transfusion of incompatible blood causing acute glomerulonephritis, acute glomerulonephritis of unknown cause, acute glomerulonephritis following exposure to cold, periarteritis nodosa following acute pneumonitis, and periarteritis nodosa with myositis. Illustrative case histories of each are presented.

(B) Cases in which lung findings are not present until the later stages of the disease. The linear pulmonary markings are prominent, and irregular patchy and confluent areas of consolidation appear. If pulmonary edema occurs, it is a terminal event and never of the azotemic type. Rheumatic pneumonitis, disseminated lupus erythematosus, dermatomyositis, rheumatoid arthritis, and possibly scleroderma are listed in this second group and case examples are given of each.

Fifteen roentgenograms; 6 photomicrographs in color.

RICHARD A. SILVER, M.D.
Indiana University

Lipoid Pneumonia. A Report of Two Cases. Herman Weissman. Am. Rev. Tuberc. **64:** 572–576, November 1951.

Two cases of lipoid pneumonia are reported. The first patient was seen in 1949 with chronic cough and dyspnea. He had previously (1918) been discharged from the Armed Services with a diagnosis of chronic bronchitis and a roentgenogram obtained in 1938 had shown abnormal pulmonary findings. Since 1933 he had been working in a machine shop, where his duties consisted of cleaning machine parts which had been immersed in oil. The cleaning was done with a hose under 150 pounds of pressure and he had noticed that the air was laden with particulated oils. He had worn no mask. Roentgenographic findings consisted of widespread fibrosis and patchy infiltration, with a considerable amount of hilar enlargement. Centrifuged sputum showed a greasy upper layer which was positive for fat when treated with Sudan IV. No biopsy was obtained, but the patient was thought to have long-standing pulmonary fibrosis aggravated by inhalation of nebulized industrial oil, resulting in patchy lipoid pneumonia.

The second patient was a chronic invalid who had difficulty swallowing fatty foods, resulting in aspiration and eventual development of cough and dyspnea. Roentgenograms showed rather dense consolidation in both medial bases which was found on aspiration biopsy to be due to oil pneumonia.

Lipoid pneumonia may be (1) diffuse acute, with interstitial proliferative inflammation with or without exudative pneumonia; (2) diffuse chronic, consisting of a proliferative fibrosis; or (3) chronic localized, with a tumor-like mass noted roentgenographically. Gradual improvement is the rule unless the fibrotic stage has been reached. The usual causes are well known, but lipoid pneumonitis in industrial workers as a result of their occupation is evidently rare.

Two roentgenograms.

JOHN H. JUHL, M.D.
University of Wisconsin

An Explanation of the "Primary Atypical Pneumonia" Syndrome. Philip W. Robertson and K. D. Forgan Morle. Brit. M. J. **2:** 994–998, Oct. 27, 1951.

Over 500 cases of what the authors believe to be "aspiration pneumonia" were observed in two years time. All were in young men undergoing the first few weeks of initial basic military training in recruit training camps, almost all of whom had been passed as normal on entry. In all cases an upper respiratory tract infection was at its height or declining. It consisted of coryza, nasopharyngitis, tonsillitis, or sinusitis. During the course of the upper respiratory infection, cough (invariably) with or without sputum, chest pain, and fever occurred. The clinical, laboratory, and roentgen findings were identical with those cases usually called primary atypical pneumonia.

The view is widely held that "primary atypical pneumonia" is an infective condition caused by an unknown virus. This view seems to have arisen largely because no other etiological factor could be found. The low white count, lack of response to chemotherapy, and clinical resemblance to influenza-like illnesses have contributed to this assumption.

The authors believe that the cases they describe, together with most of the so-called atypical pneumonias, are actually due to aspiration of products from the associated upper respiratory infections. Several reasons for their views are given, including the close correlation of the condition with upper respiratory infection and the fact that all lesions occur in dependent bronchopulmonary segments or subsegments.

The acceptance of the aspiration basis for this type of pneumonia provides an explanation for its apparently obscure epidemiology, showing that its infectivity and method of spread are merely those of the upper respiratory infection. Such pulmonary lesions, therefore, are not fundamentally different from the pulmonary complications of childhood diseases such as pertussis.

One diagram.

FRANK T. MORAN, M.D.
Lancaster, Penna.

Benign Histoplasmosis in Siblings. Report of Cases. Isidore Rod Miller and Solomon Grossman. J.A.M.A. **147:** 753–755, Oct. 20, 1951.

Pulmonary calcification is two to four times as frequent in histoplasmin reactors as in tuberculin reactors. The histoplasmin skin tests are of greatest value in the study of primary or sensitizing infections, but in the late stages of the disease the skin test may be negative.

The authors report 2 cases of benign histoplasmosis in Negro siblings aged 6 and 3 years. Both had been exposed in Mississippi eighteen months previously. In Case 1, a chest film immediately following the exposure revealed fuzzy infiltrations throughout both lung fields, interpreted as miliary tuberculosis. Symptoms of high fever, cough, and epigastric tenderness subsided and no treatment was given. A later chest film showed multiple disseminated calcific nodules throughout both lung

fields. The patient was tuberculin-negative to dilution of 1:100 and histoplasmin-positive 1:1,000. A complement-fixation test for histoplasmosis was positive in undiluted serum.

In Case 2, with similar symptoms, a current chest film showed a left paratracheal mass. This patient was similarly histoplasmin-positive and tuberculin-negative.

Three roentgenograms. I. R. BERGER, M.D.
VA Hospital, Chamblee, Ga.

Diffuse Interstitial Fibrosis of the Lungs (Report of a Case with Unusual Features). Harry L. Katz and Oscar Auerbach. Dis. of Chest **20:** 366–377, October 1951.

A 51-year-old white male was admitted to the hospital with a history of extreme shortness of breath and weakness. Exertional dyspnea had first been noted three years earlier. The patient's condition deteriorated, and two years after the onset he was practically bedridden. Oxygen had to be administered at intervals to relieve his dyspnea. Eight months before admission to the hospital, an arthritis had developed, involving the hands, left wrist, right elbow, knees, ankles, and feet, with flexion deformities of both hands and generalized muscular and subcutaneous atrophy. There were also clubbing of fingers and toes and cyanosis of the nail beds and mucous membranes. About this time a cough ensued, at first non-productive, later becoming paroxysmal and productive of a moderate amount of mucoid and tenacious sputum.

The patient's past history revealed the usual childhood diseases: pneumonia at the age of ten, attacks of influenza at nineteen and thirty, and intermittent asthmatic episodes up to the age of twenty. Between the ages of twenty-one and twenty-three he had worked as a sandblaster. For twenty years preceding the onset of the present illness he was asymptomatic and in good health.

Roentgenograms of the chest revealed diffuse, finely mottled, and patchy nodular infiltrations, more extensive in the lower lobes. The hands showed considerable demineralization, particularly about the articulations, broadening of the middle and terminal phalanges of the right fifth digit, deformities, and soft-tissue atrophy.

The patient became progressively worse; signs of congestive heart failure appeared, secondary to cor pulmonale, and death ensued, approximately three years after the onset of respiratory symptoms.

Postmortem examination of the lungs revealed a diffuse fibrosis in all lobes. The alveolar septa were irregularly and extensively thickened by an increase of loose and dense connective tissue which contained numerous capillaries, fibroblasts, histiocytes, lymphocytes, and some plasma cells. Some of the alveoli were lined with low cuboidal cells. Some of the septa had a pink hyaline appearance. Intervening alveoli were dilated, and some septa were fragmented. Vessels showed thickening of the walls by an increase of connective tissue within the intima and adventitia. The lumina of smaller arteries were obliterated by collagenous connective tissue.

This case presented certain features at variance with those usually seen. Microscopically none of the acute changes described by Hamman and Rich (Bull. Johns Hopkins Hosp. **74:** 177, 1944. Abst. in Radiology **43:** 405, 1944) as characteristic of the condition were seen. No edema, fibrin, or eosinophils were observed in the alveolar walls, and no hyaline membrane lining the alveoli. The duration of illness was considerably longer than the average, and the osseous and soft-tissue changes were unusual.

Robbins (Radiology **51:** 459, 1948) and Mallory (Radiology **51:** 469, 1948) are cited as mentioning the following conditions for consideration in the differential diagnosis: tuberculosis, pneumoconiosis, sarcoidosis, chronic inflammatory granulomatosis (beryllium), organized pneumonia (bacterial or viral), fungus disease, dermatomyositis, scleroderma, periarteritis nodosa, Raynaud's disease, lupus erythematosus, lymphatic spread of carcinomatous metastases, vascular occlusion of idiopathic pulmonary arteriosclerosis, and bronchiolitis obliterans. Many of the clinical, roentgenographic, and pathologic features in this case resembled those of scleroderma.

Five roentgenograms; 2 photomicrographs; 2 tables.
HENRY K. TAYLOR, M.D.
New York, N.Y.

Familial Pulmonary Fibrosis. John M. MacMillan. Dis. of Chest **20:** 426–436, October 1951.

The author has observed a few cases of pulmonary fibrosis with a familial tendency: a mother and daughter in one group and two sisters in another group. He cites a third group reported by Peabody *et al.* (Dis. of Chest **18:** 330, 1950. Abst. in Radiology **57:** 447, 1951). The histories of the author's patients are given, with postmortem findings in the mother and daughter, and in one of the sisters.

"Tissue repair varying as it does from complete resolution to keloid formation, the idea is entertained that perhaps such an entity as a pulmonary keloid type of response to trauma or infection is possible." Because of the familial relationships in the reported cases, the author believes that "sufficient clinical and pathological data are offered to warrant the establishing of a new disease entity, the basic etiological factor being a familial response to pulmonary trauma, of an infectional organic or inorganic nature." The disease, once it manifests itself clinically, is usually progressive to death.

Clinically, pulmonary tuberculosis was suspected in two of the cases but never proved. Pulmonary emphysema is a running mate to this entity.

Seven roentgenograms. HENRY K. TAYLOR, M.D.
New York, N.Y.

Common Pitfalls in the X-Ray Diagnosis of Tuberculosis. Joseph D. Wassersug. New England J. Med. **245:** 598–600, Oct. 18, 1951.

The author lists and briefly discusses, with a case report for each, ten different ways in which error may occur in the roentgen diagnosis of tuberculosis. It is emphasized that accurate appraisal of the patient's status is obtained only when a knowledge of the natural history of tuberculosis is combined with physical examination in the given case and bacteriological investigation of the sputum. The ten pitfalls are as follows:

(1) Failure to correlate physical findings with x-ray examination, which may lead to serious error. Scars, nevi, and other artefacts may cast a shadow on the x-ray film and be misinterpreted. In the case cited the patient was hospitalized for fifteen months because of what proved to be an artefact.

(2) Failure to compare films of similar densities, which often results in the illusion of increase or decrease in size of the lesion.

(3) Failure to place adequate emphasis on history.

(4) Reliance on inadequate x-ray examination.

(5) Comparison of x-rays taken too far apart in time.

(6) Reliance on postero-anterior films without additional views.

(7) Failure to make sputum examinations when the x-ray films show no change and special views show no evidence of further disease.

(8) Failure to recognize that basal disease may be tuberculous, particularly if it occurs in the young adult with a history of pleurisy within five years prior to the "pneumonia."

(9) Pleurisy with effusion in a young adult is often a forerunner of pulmonary tuberculosis, and such patients should not be dismissed from observation for at least five years.

(10) X-ray films are worthless unless interpreted by competent physicians. FRANK T. MORAN, M.D.
Lancaster, Penna.

Atelectasis of the Right Middle Lobe Resulting from Perforation of Tuberculous Lymph Nodes into Bronchi in Adults. Abraham G. Cohen. Ann. Int. Med. **35**: 820–835, October 1951.

Tuberculous mediastinal lymphadenitis results from the persistence or reactivation of the infection which originates with the primary complex. Among its complications are those which result from the erosion of the caseous nodes into neighboring organs. Typical lesions of tuberculous endobronchitis in the form of ulcers and tuberculous granulation tissue appear at the site of the perforation. The subsequent evolution of these lesions varies: they may spread, persist, or heal, with or without stricture formation. The protruding node may partially or completely occlude the lumen of the bronchus and affect accordingly the aeration of corresponding portions of the lung. Subsequently the node may liquefy or sequestrate, and bronchogenic spread of the tuberculous infection to the lung may result.

The bronchus of the right middle lobe is particularly vulnerable to the effects of pressure and perforation, being more densely surrounded by lymph nodes than the other bronchi. Because of its small caliber it is easily occluded. In this article, 8 cases of atelectasis of the middle lobe are reported in which, during life, the cause was established as bronchial perforation by tuberculous lymph nodes.

A review of the symptomatology and clinical findings of the cases reported indicates a fairly typical picture. The patients were all females, ranging in age from fifty-four to seventy years. With a single exception, there was no past history of pulmonary tuberculosis. The leading symptom was cough, usually slightly productive. Hemoptysis was present in 2 cases. Physical examination showed few abnormal findings. Clubbing of the fingers was not present. In 2 cases, tubercle bacilli were found in the sputum.

In every instance, roentgenograms showed atelectasis of the middle lobe without significant tuberculous or other involvement of the remainder of the lungs. Diaphragmatic motion was normal, with no mediastinal swing during breathing. In a typical case, in the postero-anterior view, there is marked decrease in the size of the lobe. This assumes a pyramidal shape, with the base against the right border of the heart and the apex extending toward the lateral chest wall. However, in most cases the borders of the shadow are ill-defined. In some, only a few infiltrations are seen. Whatever the appearance of the lesion in this view, it is impossible to determine whether it is in the middle or lower lobe. In the right lateral view, the collapsed lobe is represented by a band of increased density located in the plane of the antero-inferior portion of the longitudinal septum. The widest portion lies against the anterior chest wall or diaphragm. The upper portion of the shadow diminishes in width until it forms an apex at the junction of the longitudinal and horizontal septa. This view is diagnostic in most cases.

Ultimately, the diagnosis is established bronchoscopically. Bronchoscopic examination in the series reported showed a marked narrowing of the orifice of the middle lobe bronchus by a bulge or annular stricture in 5 cases. Anthracotic pigment was seen in the bronchial mucosa, particularly in the region of the strictures or bulges in 5 cases.

The subsequent course varied with the predominant type of pathologic change. In 1 of the 2 patients with tubercle bacilli in the sputum there was extensive bronchogenic spread to the lungs, terminating fatally. Necropsy showed perforation and obstruction of the middle lobe bronchus by caseous nodes. The other patient improved under conservative hospital care. In most of the cases the course was essentially benign.

Important clues to a tuberculous etiology are: (1) calcifications at the right hilus; (2) the presence or, especially, the sudden appearance of tubercle bacilli in the sputum in the absence of open pulmonary lesions; (3) the presence of carbon particles in the sputum; (4) the expectoration of broncholiths. Specific tuberculous lesions, such as ulcers, granulation tissue or protruding nodes, whether seen grossly or in histologic sections, are diagnostic. In the absence of such lesions, the presence of anthracotic pigment in the bronchial mucosa, particularly in the region of strictures, is circumstantial evidence of lymph node perforation.

Other bronchial diseases, particularly carcinoma, cause isolated middle lobe atelectasis much less frequently than does perforation by tuberculous nodes.

Nine roentgenograms. STEPHEN N. TAGER, M.D.
Evansville, Ind.

Value of Follow-up Studies of Children with Primary Tuberculosis. Edith M. Lincoln. Am. Rev. Tuberc. **64**: 499–507, November 1951.

Primary tuberculosis in children is potentially a serious disease. Of a series of 622 consecutive cases studied in the Children's Chest Clinic, Bellevue Hospital, New York, 23.9 per cent were fatal, although other series of reported cases show much lower mortality rates. Most children have relatively mild disease without clinical evidence of illness but complications can and do occur. Of the 622 children studied by the author, 149 died as a direct result of the first infection with tuberculosis; 60 per cent of the deaths were due to meningitis, 25 per cent to protracted hematogenous and extensive local primary tuberculosis, and 10 per cent to miliary tuberculosis without meningitis. It was found that mortality was high in infants less than six months old (over 50 per cent). Approximately 90 per cent of the deaths occurred in the first year following the diagnosis of primary tuberculosis. The influence of extent of the primary lesion was difficult to evaluate, but was also thought to be of importance, with high mortality in the few cases with extensive primary infections.

A total of 1,000 consecutive patients with primary tuberculosis were followed to the age of twenty-five years, showing an incidence of 8 per cent "reinfection" tuberculosis. More than one-half of the cases occurred in adolescents.

Because of the seriousness of the complications and the possibility of development of reinfection tuberculosis, long-term follow-up of primary tuberculosis is deemed of value. In addition, information regarding criteria for the use of chemotherapy as well as further information as to the pathogenesis of "reinfection" tuberculosis may be obtained.

Ten roentgenograms; 2 charts.

JOHN H. JUHL, M.D.
University of Wisconsin

The Tuberculosis X-Ray Survey as a Medium for Early Diagnosis of Chest Malignancy. G. Howard Gowen. Illinois M. J. **100:** 257–262, October 1951.

In a tuberculosis survey in Illinois, using 70-mm. films, 162,371 persons were examined, of whom 57,171 were forty-five years of age or over. In 332 cases the x-ray findings suggested the possibility of neoplasm. This suspicion was reported to the patient's family physician in each instance and he was offered the services of the State-aided diagnostic clinics. A little later follow-up questionnaires were sent out; 250 replies were received, 195 of which were of an informative nature. Eleven cases of malignant neoplasm were reported, none in individuals under forty-five. Six of the patients were dead by the time the questionnaires were sent out. No early case of bronchogenic carcinoma was discovered.

The author believes that the cancer case-finding program should be continued as part of the tuberculosis survey program. More might be accomplished in a survey of this type if the physicians of patients with suspicious lesions would take advantage of existing consultation service.

Eight tables.

Early Diagnosis and Treatment of Cancer of the Lung. Richard H. Overholt and Francis M. Woods. New England J. Med. **245:** 555–559, Oct. 11, 1951.

In an x-ray survey of 7,892 patients between 1938 and 1951, 477 abnormalities of the lung fields were encountered. In 191 of these, exploration was considered obligatory. Seventy-two lesions proved to be tuberculous. However, approximately as many tumors (67) were revealed, of which 39 were primary cancers of the lung. There were only 10 patients in this group in whom the carcinoma was found in the asymptomatic phase and who were promptly explored. In all of this group the tumor was resectable, and in 70 per cent no evidence of extension to any lymph node was found. In 19 cases exploration was delayed because of indecision, either by the patient or by the physician. In this group, also, all of the tumors were resectable, but only 47 per cent were free of lymphatic extension. In 900 cases of symptom-producing cancer studied by the authors, resection was possible in only 30 per cent and 89 per cent showed lymphatic extension. This report emphasizes the importance of prompt exploration of the chest when there is any possibility that a shadow seen on the roentgenogram is due to a malignant process.

Six roentgenograms; 4 drawings; 2 photographs.

On the Differential Diagnosis of Bronchial Carcinoma. W. Brunner. Schweiz. med. Wchnschr. **81:** 961–963, Oct. 6, 1951. (In German)

An early diagnosis of bronchial carcinoma is frequently impossible, as there are no characteristic signs of this disease at the onset. Pulmonary changes depend largely upon the location of the tumor and the degree of narrowing of the air passages. Centrally situated tumors give rise to atelectasis; peripheral tumors to necrosis, extrapulmonary infiltration, and metastases at an early stage.

In most of the cases a diagnosis can be made with the help of planigraphy, bronchography, and bronchoscopy, but there are still a number of cases remaining in which a diagnosis of carcinoma made preoperatively is disproved on surgery or, on the other hand, the carcinoma is first recognized at the operating table. The diagnostic difficulties are discussed and illustrated by eight case reports.

About 15 per cent of bronchial carcinomas are mistaken for tuberculous lesions. Three such cases are cited by the author. A bronchopneumonic process, also, may be of such severity as to arouse strong suspicion of a tumor. Reference is made to such a case in a 50-year-old male who came to surgery and was found to have a chronic interstitial xanthomatous pneumonia.

Seventy-five per cent of all bronchial carcinomas involve the large bronchi. Those at the periphery are difficult to diagnose, and in such cases planigraphy can be of great value. Differentiation of this group from tuberculoma is often extremely difficult. Pulmonary arteriovenous fistula and hemangioma may also simulate bronchogenic carcinoma.

The combination of carcinoma and tuberculosis is not as rare as is generally believed. Some pathologists have reported an incidence of 8 per cent of their autopsy cases. One example is cited here.

The author urges that every atypical chest roentgenogram in a patient over forty years of age be regarded as indicative of carcinoma, as long as it is not proved otherwise. He believes that in doubtful cases more biopsies should be done, even if a thoracotomy is required.

EUGENE F. LUTTERBECK, M.D.
Chicago, Ill.

A Survey of the Granite Industry in Aberdeen with Reference to Silicosis. Alex. Mair. Edinburgh M. J. **58:** 457–480, October 1951.

A two-year survey of roentgenologically demonstrable silicosis was made among the stonecutters of Aberdeen, Scotland. Of approximately 1,500 men in the monumental yards, 521 were employed in some capacity involving a known dust hazard. Three men were physically unable to appear for x-ray examination. Of the remaining 518, only 8 actually refused to report. With one exception, all who refused were elderly men, aged sixty-five or over, who quite obviously felt that they were suffering from silicosis and argued that they had nothing to gain from the study. Thirty-three retired stonemasons all appeared for x-ray examination. For all practical purposes, therefore, the findings are based on 100 per cent of the men at risk among active and retired stonecutters.

Fifty-six (9.9 per cent) of the 510 stonecutters showed some roentgen evidence of silicosis; in 35, this was of a minor degree. Only 11 workers had fairly advanced silicosis with functional disability, *i.e.*, silicosis of a

"certifiable" degree for purposes of compensation. An attempt was made to correlate "closed shed conditions" with extent and degree of silicosis. No valid conclusions were possible, but there did seem to be an association between years spent in "closed sheds" and cases of silicosis complicated by tuberculosis.

Of the 33 retired stonecutters, 27 (88 per cent) were sixty-one years of age and over, and the mean dust years for the whole group were 41.5. Over half of these men (18) showed no evidence of silicosis. Seven cases showed nodulation, 3 early reticulation, 1 massive consolidation, and 4 silicosis complicated by tuberculosis. Ten of the men with radiologic evidence of silicosis were receiving compensation, 6 of them full and 4 partial.

This survey, covering both men at work and those retired, reveals that while silicosis exists to a moderate extent, it commences so late in life and appears to progress so slowly that in all probability many stonecutters live to comparative old age and die of other diseases, without symptoms of a respiratory nature ever manifesting themselves as silicosis.

The incidence of tuberculosis in this series was no higher than would be expected in the community at large.

The author advances the hypothesis that the high death rate among Aberdeen stonecutters during the early part of the century, attributed to "phthisis," was actually due to tuberculosis and not to silicosis alone or silicosis complicated by tuberculosis.

Six roentgenograms; 6 charts; 9 tables.

X-Ray Diffraction Study of Sputum in Silicosis. Frank Meyer and Saul Solomon. Arch. Indust. Hyg. & Occup. Med. **4:** 443–445, November 1951.

The sputa of 12 persons were examined by x-ray diffraction methods. A diffraction pattern characteristic of silica was obtained in all 4 patients with severe silicosis, in 3 of the 5 patients with moderate silicosis, and in 1 of 3 patients with mild silicosis. No evidence of silica was found in the sputa of 10 control patients.

While the presence of silica has been previously demonstrated by x-ray diffraction in lung tissue obtained at autopsy, the authors believe the present study is the first successful application of the method to sputum obtained during life. The method as used in this investigation was not quantitative. Considerable work will be required to determine whether x-ray diffraction of sputum has a place in the clinical diagnosis and investigation of silicosis.

One illustration.

Roentgenologic Manifestations of Amebiasis of the Liver with Concomitant Findings in the Chest. Samuel Schorr and Armin Schwartz. Am. J. Roentgenol. **66:** 546–554, October 1951.

This paper, from Jerusalem, reports 49 cases of proved hepatic amebiasis. Sixteen of these showed roentgen evidence of chest involvement. Seven patients had fluid in the right pleural space. Two of the cases had left chest involvement as well as right, and 1 had left chest involvement only. Patchy pneumonic infiltration was observed in 6 patients, with complicating pulmonary abscess in 2. In 33 of the cases, the right diaphragm was elevated.

Early, when the disease is limited to the liver, the radiographic findings include elongation of the liver shadow and elevation of the right diaphragm. The diaphragmatic excursion may be reduced or absent. Occasionally, a solitary abscess near the hepatic periphery may produce a localized impression on the diaphragm or depress the gallbladder shadow, depending, of course, upon its location.

Chest involvement comprises obliteration of the costophrenic or cardiophrenic sinuses, pleural effusion, and pneumonic consolidation with or without abscess formation. A linear string-like perpendicular shadow may be seen in the right lower lung field in addition to a fixed and deformed diaphragm. This last roentgen finding might be an additional aid in the diagnosis of amebiasis of the chest and worthy of further study.

Rarely the left diaphragm and lung are involved, indicating disease of the left lobe of the liver.

Twenty-four roentgenograms.

JOHN W. WILSON, M.D.
Indiana University

Angiocardiography in the Differential Diagnosis of Aneurysms of the Great Vessels and Mediastinal Tumors. C. da Rocha Pinto, Américo Nunes, and J. Martins da Fonseca. Gaz. méd. Portuguesa **4:** 383–390, 1951. (In Portuguese)

The authors stress the advantages of angiocardiography over conventional roentgen methods in the differential diagnosis of aneurysms and mediastinal tumors. Aneurysms ordinarily fill with contrast medium, thus becoming opaque along with their vessels of origin, while the density of mediastinal tumors remains the same throughout the examination. Because of a blood clot or a small neck, the aneurysm may not fill with the contrast medium but even in this event some abnormality of the great vessels may be seen which will give a clue to the diagnosis.

Angiocardiography has been employed by the authors in more than 60 cases, mostly of congenital heart disease. A solution of 70 per cent Diodrast has been used as the contrast medium; it is injected through the skin without exposing the vein, with local novocaine anesthesia. The injection is made into an antecubital vein in less than two seconds. The patient is recumbent during the examination. Frontal and right posterior oblique projections are generally taken, using a cassette-changing device which permits five exposures in six or seven seconds. No serious reactions have occurred.

Five cases are reported, 3 of aneurysm and 2 of mediastinal tumor.

Eighteen roentgenograms.

Some Aspects of New Methods of Diagnosis in Cardiology: Angiocardiography and Intracavitary Catheterization. E. Coelho, J. M. Fonseca, Rocha Pinto, A. Nunes, and F. Barros. Gaz. méd. Portuguesa **4:** 751–774, 1951. (In French)

After a discussion of the two newest methods of diagnosis employed in cardiology—angiocardiography and right heart catheterization—the authors present a number of angiocardiograms as examples of various congenital and acquired cardiovascular diseases. They emphasize the necessity of associating angiocardiography with catheterization. In some malformations of the heart, *e.g.*, interauricular communication, interventricular communication, and patent ductus arteriosus, catheterization is of greater value and in other con-

ditions angiocardiography is more enlightening. The importance of the various steps in catheterization (introduction of the catheter, withdrawal of blood samples, measurement of intracavitary pressures, and electrocardiography) and of all the steps combined are shown in different malformations. The authors' findings on catheterization in 28 cases of congenital heart disease and 12 cases of acquired heart disease are presented in tabular form. In the majority of these patients the shunts, the systemic flow, and the pulmonary flow were calculated in accordance with the Fick principle. In conclusion it is pointed out that in a large number of cases of cardiac malformation, diagnosis can be made only by the classical procedures, that is, by clinical and roentgenoscopic examination.

Forty-nine roentgenograms; 9 electrocardiograms; 2 tables.

Disturbances in Cardiac Mechanism of Several Hours' Duration Complicating Cardiac Venous Catheterization. Noble O. Fowler, Richard N. Westcott, and Ralph C. Scott. Am. Heart J. **42**: 652–660, November 1951.

Myocardial Damage Following Inadvertent Deep Cannulation of the Coronary Sinus During Right Heart Catheterization. Warren W. Smith, Roy E. Albert, and Bertha Rader. Ibid. pp. 661–666.

The two papers listed above deal with complications following cardiac catheterization. Fowler and his associates present 8 cases in which disturbances in the cardiac mechanism, demonstrated electrocardiographically, were observed. These occurred among 110 venous catheterizations of the right side of the heart in 106 subjects. Right bundle branch block developed in 6 cases, auricular fibrillation in 1 case, and frequent ventricular premature contractions in 1 case. In each instance the arrhythmia disappeared within twelve hours. The complication was seen as often in normal as in diseased hearts.

Smith *et al.* report a case of myocardial damage following cardiac catheterization in the process of which the catheter was inadvertently advanced deeply into the coronary venous tree for several minutes. Electrocardiographic changes developed immediately on introduction of the catheter and subsequently assumed the configuration characteristic of pericarditis. That this is not an isolated occurrence is shown by reference to several cases seen in another laboratory.

It is believed that catheterization of the coronary venous system is dangerous only if the catheter has a relatively large outside diameter and is inserted deeply. It is therefore suggested that great care be taken in catheterizing the right ventricle and that the course of the catheter be checked by fluoroscopy in the right oblique position and by observing the pattern of the pressure tracing from the catheter tip immediately after it has appeared to traverse the tricuspid valve.

Both papers are illustrated by electrocardiographic tracings.

Extracardiac Arteriovenous Fistulas in the Thorax. Ernesto J. Marchand, Milton R. Hejtmancik, and George R. Herrmann. Am. Heart J. **42**: 682–697, November 1951.

Theoretically, five different types of arteriovenous communication are possible within the thorax: from the aorta to the pulmonary artery; from the aorta or peripheral artery to a systemic vein; from the pulmonary artery to the pulmonary vein; from the aorta to the pulmonary vein; from the pulmonary artery to a systemic vein. The authors present 3 representative cases of the first three types.

In the first case a communication between the aorta and pulmonary artery was presumably the result of a rupture of a syphilitic aneurysm of the aorta. In August 1949, the patient had suffered a sharp, constricting substernal pain, at which time the rupture presumably occurred. This was followed by the syndrome of chronic severe right ventricular failure. A postero-anterior film of the chest showed cardiac enlargement, with particular prominence of the pulmonary conus region, pulmonary congestion, and fluid in the right hemithorax. Following a temporary response to treatment, cardiac decompensation recurred and intracardiac catheterization was done, confirming the presence of a shunt from the aorta to the pulmonary artery.

The second patient complained of severe intermittent substernal pain of about six months duration, hoarseness for twelve months, and progressive swelling of the right arm, face, and neck. The findings on examination were typical of aortic rupture into the superior vena cava and the clinical impression was confirmed by the presence of marked pulsations of the saline column in venous pressure determinations in the upper extremities and increased oxygen content of the venous blood in the upper extremities. X-ray studies of the chest revealed a huge mass in the right anterior chest, measuring about 18 × 14 cm. The patient died suddenly, and at autopsy a large aneurysm of the aorta was found which had ruptured into the superior vena cava producing an arteriovenous communication.

The third case was of pulmonary hemangioma in a patient with hereditary hemorrhagic telangiectasia. The diagnosis was made on clinical grounds and proved at operation. This is said to be the second reported case with a superimposed subacute bacterial endarteritis. The patient had fever, embolic phenomena, and positive blood culture, *Staphylococcus albus* being found. Roentgenograms of the chest revealed a somewhat irregular shadow about 5 cm. in diameter, continuous with the vascular markings in the hilar area in the postero-anterior view, situated at the base of the right lung anteriorly. The shadow decreased on fluoroscopy with the Valsalva test and became larger with the Mueller maneuver. The bacterial infection responded to penicillin therapy. Surgical exploration later disclosed two smaller hemangiomas of the right lung in addition to the larger lesion previously demonstrated.

Ten figures, including 4 roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Congenital Pulmonary Valvular Stenosis. R. B. Blacket, A. Jean Palmer, and E. J. Halliday. M. J. Australia **2**: 517–527, Oct. 20, 1951.

Congenital pulmonary stenosis may or may not be accompanied by a patent foramen ovale. The degree of stenosis is another variable factor and determines the amount of disability. Where there is little restriction of flow there may be practically no disability.

The present paper is based on a study of 11 cases in which the clinical diagnosis was confirmed by cardiac catheterization. Three case histories are given at some length. Systolic murmur and thrill were the com-

mon signs, with fatigue and dyspnea the common symptoms. Cyanosis was seen in 2 patients. Roentgenographic findings consisted of enlargement of the right ventricle (8 cases) and of the right auricle (5 cases), poststenotic dilatation of the pulmonary artery (9 cases), and normal or diminished peripheral lung vessel markings. Angiocardiography was done in only 4 cases. In general, it confirms the findings on the plain films, shows delayed emptying of the right ventricle, and often demonstrates the actual constriction.

Heart catheterization demonstrates the drop in pressure from the right ventricle to the pulmonary artery. It also rules out an interventricular septal defect.

Surgical dilatation of the stenosis has proved to be a practicable procedure and should be considered in every case with significant stenosis.

Nine roentgenograms; 4 electrocardiograms; 1 pulse tracing; 4 tables. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

THE DIGESTIVE SYSTEM

Esophageal Sensitivity to Mecholyl in Cardiospasm. Philip Kramer and Franz J. Ingelfinger. Gastroenterology **19:** 242–251, October 1951.

Application of the balloon-kymograph technic to the study of esophageal disorders has been found to supplement radiography and to bring to light mechanisms not readily detected by other methods. By this means the authors previously demonstrated diffuse abnormality of esophageal motility and hypersensitivity to Mecholyl in a few patients with cardiospasm (Am. J. Med. **7:** 174, 1949). They now report a further study on subjects without esophageal disease, on additional patients with cardiospasm, and on a group with other esophageal disorders. Observations were made using a balloon kymograph and barium swallow with fluoroscopy before and after injection of Mecholyl.

The response to Mecholyl was the same in all the patients with cardiospasm, regardless of its degree: tetanic contraction of the lower esophagus one or two minutes after the injection. Severe substernal pain was almost invariably associated. These results were not observed in any of the other subjects. Thus Mecholyl might be considered useful in the differential diagnosis of esophageal disorders.

The pathogenesis and physiology of cardiospasm are discussed and the following conclusions derived: Cardiospasm is probably a neuromuscular dysfunction with three major attributes: (1) a tapered narrowing in the distal 2 to 4 cm. of the esophagus persisting during and after swallowing, presumably because motor integration between this part of the esophagus and the remainder has been interrupted; (2) abnormal peristaltic activity and impaired propulsion, with a variable decrease in tone, affecting the lower one- to two-thirds of the esophagus to the point of relative narrowing; (3) hypersensitivity of the lower one- to two-thirds of the esophagus to parasympathomimetic agents.

Four roentgenograms; 18 kymographic tracings; 1 table. ALLIE WOOLFOLK, M.D.
Pittsburgh, Penna.

Healing of Peptic Ulcer. Maurice Feldman and Tobias Weinberg. Am. J. Digest. Dis. **18:** 295–296, October 1951.

A comparison of the incidence of gastric and duodenal ulcers based on clinical and roentgenologic observations with the incidence as determined by postmortem studies was made by the authors. Stewart, Bockus, and others have estimated the incidence of peptic ulcer to be about 10 per cent in the general population. In a study of 1,082 consecutive necropsies the present authors found 54 active and 18 healed ulcers, a total incidence of 6.7 per cent. The incidence of healed ulcer was 1.7 per cent.

It is concluded that the discrepancy between the clinical and necropsy observations is attributable to the fact that many ulcers heal so completely that they leave no scar. JOSEPH T. DANZER, M.D.
Oil City, Penna.

Healing of a Primary Duodenal Ulcer with the Later Development of a Gastric Ulcer. Samuel Morrison and Maurice Feldman. Am. J. Digest. Dis. **18:** 296–298, October 1951.

The authors, in a study of 500 cases of peptic ulcer, found 21 in which both duodenal and gastric ulcer were present. In 15 cases both ulcers were active, while in 6 there was clinical and roentgenologic evidence of a healed duodenal ulcer and an active gastric ulcer. In these 6 cases the lapse of time between the healing of the duodenal ulcer and the finding of the gastric ulcer ranged from one to twenty-seven years.

A typical case of a completely healed duodenal ulcer with the development, after ten years, of a new gastric ulcer is reported.

It is emphasized that, when a patient is found to have a peptic ulcer which has shown roentgen and clinical evidence of complete healing, recurrence of digestive symptoms after an indeterminate period may indicate the formation of a new ulcer at a different site.

Prolapse of the Gastric Mucosa into the Duodenum. I. W. Kaplan and R. M. Shepard. J. A. M. A. **147:** 554–560, Oct. 6, 1951.

The protrusion of the gastric mucosa through the pylorus into the duodenum is not an uncommon occurrence. Most writers are in agreement that it occurs in about 1 per cent of patients with gastrointestinal disease. Forty-one cases proved by operation were found in the literature. A much larger number have been diagnosed roentgenographically without surgical confirmation.

The etiology is unknown, but several theories have been advanced. One is that the mucosa becomes thickened by inflammation and is pushed by hyperperistalsis through the pylorus. Another theory is that a degeneration of the pyloric muscle occurs, allowing a prolapse of the antral mucosa through a patent ring. On operation, the prolapsed portion of the gastric mucosa looks like a loose collar of tissue that may or may not be thickened, as in chronic gastritis.

Symptoms are variable and non-specific. They may be present for weeks or for years. The most frequent complaints are epigastric distress, nausea and vomiting aggravated by food, and the presence of occult blood in the stool. The latter finding, the authors feel, is of more significance than any other. It occurs in 40.9 per cent of cases.

Roentgenograms show a typical central filling defect near the base of the bulb, giving it a mushroom-like appearance. In some cases the gastric rugae can be traced into the defect. Since the prolapse is often intermittent, repeated examination may be required for a diagnosis.

The treatment should include a trial of antispasmodics and soft diet for a month. If there is no relief, surgery is recommended.

Four cases are described in which the mucosal prolapse was demonstrated at operation. In 3 the diagnosis had been made preoperatively. In 1 roentgen diagnosis was possible early carcinoma. A table summarizes the proved cases from the literature.

Four roentgenograms. JOSEPH T. DANZER, M.D.
Oil City, Penna.

Carcinoid of the Duodenum. John R. Hannan, John B. Hazard, and Robert E. Wise. Am. J. Roentgenol. **66**: 569–576, October 1951.

Three cases of carcinoid of the duodenum are presented, raising the total of reported cases to 11. All of the authors' cases showed roentgenologically a solitary rounded or vacuolated defect, such as may be produced also by adenoma, myoma, papilloma, or pancreatic rest. These three carcinoids differed in no way microscopically from those in other locations, but a polypoid appearance is unusual in other portions of the gastrointestinal tract. None of the duodenal carcinoids reported have been malignant, yet local infiltration of the mucosa and submucosa and adjoining muscularis was present in these cases. Since the tumors are slow growing, and in view of the malignant character of carcinoid in the ileum, they should not be regarded as totally benign. Local excision should afford an excellent prognosis. Progress examination of two of the cases showed no recurrence in eleven and twenty-eight months.

Four roentgenograms; 3 photomicrographs; 1 photograph. DAVID C. GASTINEAU, M.D.
Indiana University

Lipomatous Hypertrophy of the Ileocecal Valve. Monte Edwards and Henry Zangara. Am. J. Surg. **82**: 533–537, November 1951.

Interest in lipomatous hypertrophy of the ileocecal valve arises not so much from its rarity as from the diagnostic criteria which may lead to its more frequent recognition. Its location at an anatomic narrowing of the bowel and its peculiar behavior on barium enema study, along with the uncertainties attendant on surgical interference, give it some resemblance to prolapse of the gastric mucosa through the pylorus.

Two cases which proved to be lipomatous hypertrophy of the ileocecal valve are presented. In one, the only definite abnormality demonstrated on barium enema examination was a rather deep indentation on the medial wall of the cecum at the junction of the ileocecal valve, at the site of the lowermost circular contraction. The mucosal pattern was well visualized on the post-evacuation roentgenogram. At this time a filling defect measuring about 4 cm. in length and approximately 2 cm. in width was observed. On the evacuation film, the defect appeared well defined. The effect was suggestive of the mushrooming seen in its pyloric counterpart. It was thought that the lesion probably represented a new growth. In the other case, at the junction of the ascending colon with the cecum, there was a rounded, well defined filling defect intruding into the lumen of the colon. The mass measured 4 cm. in its greatest diameter and had a slightly irregular periphery. In spite of the use of as much pressure as the patient could tolerate, none of the barium could be forced into the terminal ileum. The lesion was thought to be a neoplasm, either an adenocarcinoma or a carcinoid. In both of these cases, the disabilities were minor and the x-ray findings uncertain, but surgery was felt to be justified because of the possibility of malignant tumor.

Four roentgenograms; 2 photographs.

Maximal Diagnostic Potential of Barium Enema in the Management of Colon Disease. James A. Ferguson. Am. J. Surg. **82**: 553–555, November 1951.

The author attempted to assess the value of the barium enema examination in a large group of patients who on thorough clinical study, including proctosigmoidoscopy, showed no evidence of intrinsic disease of the colon. The investigation covered 600 patients, all of whom sought medical aid for the relief of real or fancied anal distress. No patient with a history of change of bowel habit, tarry stools, or weight loss was included. Patients with a palpable or visible tumor in the lower bowel or with abnormal mucosa, lumen, or bowel content were also excluded. All radiographic studies were made by qualified roentgenologists.

In 74 of the 600 cases the barium enema study revealed a completely unsuspected abnormality of the colon. Seventy patients were found to have diverticulosis of the colon of minimal to severe degree, and 12 of these showed evidence of diverticulitis though they were asymptomatic at the time. Four patients had intrinsic new growths of the colon, 3 solitary polypi of the colon, and 1 a large carcinoid of the cecum. Thus, 16 patients had colon abnormalities of real clinical significance. Colotomy and polypectomy were done in 3 patients and right colectomy and ileotransverse colostomy in a fourth. Histologic examination showed the polypi to be benign.

In the author's opinion, x-ray examination of the colon during and following the injection of barium per rectum should be an integral part of the diagnostic routine in all cases of anorectal disease.

Two roentgenograms; 1 photograph.

Roentgenologic Aspects of Diverticulitis and Its Complications. Russell Wigh and Paul C. Swenson. Am. J. Surg. **82**: 587–596, November 1951.

Diverticulitis, a frequent disease after the age of forty, produces numerous intra-abdominal complications, but because infection occurs in the distal colon, most of the secondary changes appear in the pelvis and left abdomen. These secondary changes are the direct result of infection and give rise to abscesses, fistulas, and obstruction. Any of these may simulate carcinoma.

Roentgenologically, peridiverticular abscesses are of two types: first, abscesses that are identified by a palpable mass contiguous with the bowel or by their displacement effect on the bowel; second, abscesses that are recognizable as such on the roentgenogram because their communication with the lumen of a diverticulum which has perforated is sufficiently large to permit ingress of an opaque mixture.

Fistula formation as a complication of diverticulitis is quite common. About 10 to 15 per cent of all cases of diverticulitis coming to surgery have bladder fistulas. Fistulas have also been found communicating with the ureter and with the stomach. In the absence of demonstrable diverticula, a fistulous tract is attributed to cancer. Therefore when the differential problem

arises in a patient without obstruction, barium should be given by mouth in an effort to demonstrate the sacs of the diverticula.

Localized inflammatory processes subside more often than they go on to perforation. The bowel wall may become perfectly normal. If, however, recurrence follows recurrence, the wall becomes thickened, with reduction in the size of the lumen and possible obstruction.

The complications of diverticulitis are also the complications of neoplasm in the same region. In the differential diagnosis, some features are helpful. The area of involvement in sigmoiditis is usually of greater length than in carcinoma, and mucosal contours are much better preserved in the constricted area. When a mass is present, it is more likely to be tender. When obstruction occurs, spasm usually makes it complete. Generally, when the entire lesion can be outlined, cuffing, overhanging edges, or shelving will be found in carcinoma to occur at the extremities of the lesion; that is, there is an abrupt transition from relatively normal to abnormal bowel. In an inflammatory process, a more gradual transition is observed.

Eleven representative cases illustrating the more common situations met by the roentgenologist are presented.

Twenty-two illustrations.

Calcification of the Gallbladder Wall. Report of a Case of So-called "Porcelain Gallbladder." Kalevi Kettunen. Acta radiol. **36:** 341–344, October 1951.

The author presents the case of a 64-year-old woman with a right upper quadrant mass of thirty years duration. There was no history of serious illness and there were no typical gallbladder symptoms. Retrograde pyelography showed a normal right kidney, but a shadow with a calcified periphery was seen. A roentgen diagnosis of calcified gallbladder was made. At operation the gallbladder was found to be distended by a mucinous material but there were no stones. The cystic duct was completely blocked. The calcifications were in the subserosa and in the muscularis.

The author makes a point that has not been stressed in previous reports of calcification of the gallbladder. He feels that the calcification results from a chronic infection obstructing the cystic duct. This leads to distention, followed by impaired function and atrophy of the muscular layer with fibrous replacement. The basic factor in all cases is believed to be obstruction of the cystic duct.

Two roentgenograms; 1 photograph; 1 photomicrograph. DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Left-Upper-Quadrant Gallbladder. Alan R. Bleich, Donald O. Hamblin, and Dorothy Martin. J. A. M. A. **147:** 849–851, Oct. 27, 1951.

A normally functioning left-sided gallbladder, not associated with situs inversus or other anomalies, was revealed by roentgen studies in a 28-year-old man with recurrent mild upper-abdominal pain. The ectopic gallbladder shadow was demonstrated on a 14 × 17-inch film after it had failed to appear on conventional size roentgenograms of the right upper abdominal quadrant. This is the eleventh case of left-sided gallbladder without situs inversus to be reported, and the fourth discovered preoperatively by roentgenologic methods.

Four roentgenograms.

Pneumoperitoneum Following Tonsillectomy. Arnold Rogers and F. W. Jones. Gastroenterology **19:** 349–354, October 1951.

A case is presented of a fifteen-year-old white girl with massive spontaneous pneumoperitoneum following tonsillectomy. Plain films showed a great volume of air in the abdominal cavity, outlining the liver, spleen, and gastrointestinal tract. Therapy consisted of aspiration, with administration of penicillin and streptomycin.

The possible sources of the air are discussed. Perforation of the small intestine seemed most likely, since about a week after the tonsils were removed intestinal obstruction developed, found on laparotomy to be due to adhesion of the ileum to the uterus. A point against this possibility was the lack of odor in the aspirated gas.

Four roentgenograms. ALLIE WOOLFOLK, M.D.
Pittsburgh, Penna.

THE MUSCULOSKELETAL SYSTEM

Subperiosteal Resorption of Bone: A Roentgenologic Manifestation of Primary Hyperparathyroidism and Renal Osteodystrophy. David G. Pugh. Am. J. Roentgenol. **66:** 577–586, October 1951.

The author investigated the frequency of subperiosteal bone resorption in primary hyperparathyroidism and in renal osteodystrophy. A study was also made of various forms of osteomalacia and osteoporosis to determine if subperiosteal bone resorption occurred in those conditions.

Subperiosteal resorption is most frequently seen in the phalanges of the hands. It is unusual in the phalanges of the feet. The next most frequent site is along the medial aspect of the upper third of the tibia. Occasionally the inferior aspect of the distal third of the clavicle and the margins of the distal end of the ulna are involved. This resorption does not consist of a mere decalcification of the cortex but rather gives a peculiar lace-like appearance to the bone beneath the periosteum. Sometimes the external surface of the cortex has a ragged spicule-like appearance.

After hyperparathyroidism has been surgically corrected, subperiosteal bone regeneration is rapid and the cortex appears normal. There is never any permanent loss of the cortex. The tufts are completely reformed.

The loss of the lamina dura as seen in dental roentgenograms is another manifestation of subperiosteal resorption of bone. The periodontal membrane is a specialized form of periosteum. The lamina dura is actually the cortical portion of bone around the teeth.

Of 76 cases of primary hyperparathyroidism proved at surgery, 50 per cent showed no roentgenographic evidence of bone disease. All but 5 of these 38 patients, however, had urinary calculi. In this entire group alkaline phosphatase determinations were essentially normal.

In 11 cases (14 per cent) of primary hyperparathyroidism, slight or moderate decalcification was present, without subperiosteal bone resorption. None of these cases showed sufficient osseous abnormality to justify a roentgenographic diagnosis of hyperparathyroidism and in none were cysts of the bone present. It is questionable whether the decalcification was the result of hyperparathyroidism or some type of osteoporosis.

In 2 cases (3 per cent), cysts of the bone were seen without evidence of subperiosteal bone resorption.

In the remaining 25 cases (33 per cent) subperiosteal resorption of bone was present. The average level of alkaline phosphatase in 23 of these cases was 16.4 Bodansky units with a maximum of 43.1 and a minimum of 6.7. In view of these elevated alkaline phosphatase levels and the normal findings in the patients without subperiosteal resorption, the author concludes that a high level of serum alkaline phosphate seems to be a most accurate indication of skeletal disease in hyperparathyroidism.

Thirty-five cases of renal insufficiency were studied, including cases diagnosed as renal rickets, renal dwarfism, renal infantilism, and renal osteodystrophy. Seven patients (20 per cent) had generalized decalcification without rickets or subperiosteal bone resorption, while 2 (6 per cent) had rachitic changes without subperiosteal resorption. In 26 patients (74 per cent), all with severe renal insufficiency, subperiosteal bone resorption was found. In 11 cases the average alkaline phosphatase was 22.7 Bodansky units. The subperiosteal resorption in these 26 cases was identical with that seen in primary hyperparathyroidism. A peculiar finding of bone resorption was noted along the margins of the sacroiliac joints in adult patients. This resorption caused the joints to become indistinct, producing an appearance suggestive of rheumatoid spondylitis.

In the cases of osteomalacia, osteoporosis, and hypervitaminosis D studied, no evidence of subperiosteal bone resorption was discovered.

The author concludes that subperiosteal bone resorption occurs only in primary hyperparathyroidism and in renal osteodystrophy. There is also evidence that indicates that in renal osteodystrophy with subperiosteal bone resorption a state of secondary hyperparathyroidism is present.

The possible mechanisms whereby renal osteodystrophy causes secondary hyperparathyroidism are discussed, but the cause remains obscure.

Fifteen roentgenograms; 2 tables.

W. L. BRIDGES, M.D.
Indiana University

Reflex Hyperemic Deossifications. Alfred A. deLorimier. Bull. Hosp. Joint Dis. **12**: 22–37, October 1953.

Failure to identify the entity of hyperemic deossification has resulted in prolonged disability and pain in many instances, in unnecessary and troublesome incisional procedures in some, and too often in unnecessary amputations.

This type of deossification is characterized by localized areas of bone dissolution which are rendered conspicuous because of the substantial structure of contiguous bone. This appears to be an active deossification in the sense that osseous constituents are actually washed out at sites of abundant blood supply. As such, it should be distinguished from the passive type of bone deficiency where there is a lack of normal stimuli for deposit of the inorganic constituents. Sudeck, in 1901–02, considered the condition to be a "reflex trophoneurosis" on a vasomotor basis. He emphasized that these changes do not occur where the reflex arc is broken, as in such conditions as poliomyelitis, tabes dorsalis, and syringomyelia.

Two hundred and thirty-nine cases are reviewed in which the spotty hyperemic type of deossification was found. Clinical investigation revealed the following etiologic factors: (1) various types of trauma, (2) infections, and (3) neoplasms, with trauma predominating.

The following patterns of deossification were noted:

(1) Discrete mottlings through a large portion of the bone or throughout several bones of a part. This type of deossification is thought to be related to hyperemia of terminal branches of the nutrient artery and their anastomoses with cortical perforating vessels (as contained in Volkmann's canals).

(2) Deossifications in metaphyseal zones or throughout the ends of the bones. In some instances a distinct "banding" or rarefaction was found in the metaphyseal zones. It is felt that this pattern is one of a particular hyperemia of the perforating metaphyseal vessels and their anastomoses with epiphyseal branches of the cortical perforating vessels of the bone.

(3) Deossifications beneath the subchondral articular cortices. This appears to be due to hyperemia of the terminal arcuate vessels which ordinarily nourish the articular cortices and the joints themselves.

(4) Progressive stages of reflex hyperemic deossification appear to be manifested by two or all three of these patterns and, finally, by diffuse mottling of rarefaction which, in many instances, involves all portions of a bone or several bones. The explanation for these more extensive changes appears to be a widespread hyperemia, or the element of time may account for a gradual expanse in the absorptions. The factor of disuse may also contribute, the result being a combination of the two types of deossification: active hyperemic deossification together with the passive deficiency of stimulation for deposit of the inorganic constituents along the lines of stress and strain.

Sixteen roentgenograms.

THOMAS F. ULRICH, M.D.
The Henry Ford Hospital

Pachydermoperiostosis. The Syndrome of Touraine, Solente and Golé. G. H. Findlay and W. J. Oosthuizen. South African M. J. **25**: 747–752, Oct. 13, 1951.

Pachydermoperiostosis is an interesting and uncommon syndrome which has appeared in the European literature under various titles and has been described in America [under the designation "chronic idiopathic hypertrophic osteo-arthropathy"] by Camp and Scanlan (Radiology **50**: 581, 1948). In its typical form the disease affects the skin and bones. The skin shows hypertrophy which commonly involves the scalp, eyelids, and hands. The digits are clubbed. In the case reported here, the facial expression—because of the redundant skin folds of the forehead, and the hypertrophy of the eyelids—is described as "woebegone." The skin hypertrophy is apparently due to an increase in collagen and elastic tissue in the corium.

X-ray examination shows hyperostosis, usually in the distal portion of the limbs. The new periosteal bone fuses with the old cortex and gives a cylindrical or barrel-shaped appearance to the tubular bones.

The disease is confined to males and tends to be familial. Usually it begins soon after puberty and progresses slowly and painlessly for several years. Natural arrests may occur. The etiology is unknown.

Pachydermoperiostosis can be confused with acromegaly, hypertrophic pulmonary osteoarthropathy, and "thyroid" acropachy. The absence of any increase in bone length, the normal mandible, and the unaffected terminal phalanges aid in distinguishing it from the first of these. Hypertrophic pulmonary osteoarthrop-

athy can be ruled out by the absence of heart or lung disease in this entity, and by the type of periosteal reaction. In the former this is of inflammatory type, the new cortical bone being deposited in rings, with a soft-tissue layer between the old and the new cortex. In the latter, as pointed out above, the new periosteal bone fuses with the existing cortex. "Thyroid" acropachy occurs frequently after thyroidectomy for hyperthyroidism. "Malignant" exophthalmos may be present. The hands may show subperiosteal new bone and clubbing of the digits. Edema of the upper and lower eyelids may simulate the skin hypertrophy seen with pachydermoperiostosis.

The authors' patient was a South African native showing several unusual features. One of these was a lowered basal metabolic rate. Another was enlargement of the left ventricle of the heart.

Three roentgenograms; 1 photograph; 1 table.

D. D. ROSENFELD, M.D.
Fontana, Calif.

Gargoylism (Hunter-Hurler Disease, Dysostosis Multiplex, Lipochondrodystrophy); Prenatal and Neonatal Bone Lesions and Their Early Postnatal Evolution. John Caffey. Bull. Hosp. Joint Dis. **12:** 38–66, October 1951.

The author defines well the clinical and radiologic findings of gargoylism and clarifies the differential diagnosis. The clinical complex includes dull coarse facies; multiple deformities in the head, neck, and trunk; semiflexion and limitation of motion at several joints; mental retardation; hepatosplenomegaly; and clouding of the corneas. Variation in both number and degree of these components is common, and is one of the most characteristic features of the syndrome. A wide, flat, thick, snub nose with big nostrils is, in the author's experience, consistently present in gargoylism.

Bones in the head, trunk, and extremities may be affected. Distribution of the bone lesions is characteristically uneven. Usually bones of the hands and arms and the ribs show the most marked roentgen changes. The bones in the legs, in contrast, are little affected, and diagnostic changes rarely develop in them. The basic lesion in tubular bones is swelling of the shaft due to distention of the medullary cavity, with thinning of the cortical walls, though the latter may be thickened during the first years of life. The external contours are further deformed by incomplete modeling and tubulation which produce shafts with tapering, pinched-off ends resembling the outlines of sausages or bananas. Occasionally both ends of the shaft remain swollen and its central segment is constricted in a dumbbell shape. Uneven increase in the girth of the shafts is the most important single diagnostic skeletal change.

The roentgen changes at the cartilage-shaft junctions and the epiphyseal plates, in contrast, are minimal and are not diagnostic in themselves. Often the epiphyseal plates of the radius and ulna are tipped toward each other, owing to retarded longitudinal growth in the epiphyseal cartilages on the shorter sides of each of these shafts. The paucity of metaphyseal changes and the conspicuous and consistent diaphyseal expansion differentiate gargoylism sharply from the osteochondrodystrophies, such as achondroplasia and Morquio's disease, in which the metaphyseal changes are pronounced and diaphyseal expansion is lacking.

The cause of gargoylism is not known. A genetic origin is suspected. Pathogenesis is likewise obscure. Current hypotheses favor widespread intracellular deposition of lipids or glycogen in many tissues as the likely mechanism.

The most consistent anatomical changes are found in the neural and osseous systems. The age of the patient at the time of the clinical onset and the time of the appearance of the diagnostic changes in the skeleton is unknown. The usual time for clinical signs is apparently at six to twelve months of age, though they have been seen to appear as early as two months and as late as nine years.

Two cases are presented in which the bones during the first month of life showed generalized rarefaction and metaphyseal spreading, cupping, and spurring. Extra subperiosteal sleeves of cortex of varying thicknesses enveloped many of the shafts and thickened them externally. The author feels that it is probable that these neonatal bone lesions represent a heretofore unrecognized initial phase of skeletal gargoylism during which lipids or glycogen are being deposited in all parts of the bones.

Twenty-four roentgenograms; 23 photographs.

THOMAS F. ULRICH, M.D.
The Henry Ford Hospital

Gargoylism. Robert McDonald and W. H. Opie. South African M. J. **25:** 725–730, Oct. 6, 1951.

A case of gargoylism, one of the first to be reported from South Africa, is presented. This patient exhibited, at the age of five months, most of the typical features of gargoylism, including a severe degree of hydrocephalus. X-ray examination of the spine showed the "beaking" of the lower parts of the 12th dorsal, and the first and second lumbar vertebrae usually described in this condition. The anterior ends of the ribs appeared much broader than normal, and there was an abnormal degree of broadening of the bodies of the metacarpals and phalanges. Apart from the hydrocephalus, the skull was normal.

Four roentgenograms; 2 photographs.

Roentgen Appearance of Early Paget's Disease. William B. Seaman. Am. J. Roentgenol. **66:** 587–594, October 1951.

Paget's disease, or osteitis deformans, is characterized by the absorption of bone and the formation of new bone of an abnormal character. Moore in 1923 described the two processes of rarefaction and condensation proceeding side by side (Am. J. Roentgenol. **10:** 507, 1923), but later Sosman (Radiology **9:** 396, 1927) reported a case in which only the destructive phase was present, designating it as monophasic Paget's disease. The author of the present paper reports two cases in young men, aged 24 and 27, with expansile osteolytic lesions in the tibia along the anterior cortex. One of the cases was followed for thirteen years, at the end of which time fully developed Paget's disease was shown by biopsy. The other had a few coarse trabeculations in the adjacent bone when first seen. Reference is made to a similar case recently reported in which transition from monophasic to typical Paget's disease occurred in approximately a year (Tavernier: Lyon chir. **45:** 275, 1950). These cases are regarded as substantiating the view that the initial change in Paget's disease is bone resorption.

Paget's disease may be present without symptoms in either younger or older individuals for years, being dis-

covered only on a routine x-ray examination. Usually typical Paget's disease with osteoblastic activity is seen in the sixth decade, but cases in 18- and 28-year-old males have been reported.

The most frequent complication of Paget's disease, namely, pathological fracture, was observed early in one of the author's cases. It is said to occur in about 8 per cent of all cases recorded in the literature. Another, not infrequent complication, namely, the presence of renal calculi, was also observed in this case.

Histologically, biopsy studies of early osteolytic monophasic Paget's disease frequently show nearly normal bone in contrast to the typical mosaic trabecular pattern seen in the fully developed phase.

The roentgenographic finding of a fusiform, expansile radiolucent cortical lesion with V-shaped demarcation at the upper and lower limits is as characteristic of monophasic Paget's disease as is the dense, thickened cortex with coarsened trabeculae of the advanced stage. Hyperparathyroidism may be suggested by the early monophasic form, whereas the fully developed phase may be confused with syphilis and osteoblastic carcinoma.

The factors of stress and strain may explain the rarity of monophasic lesions in the skeleton outside the skull. Osteoporosis circumscripta has been found in about 20 per cent of cases with cranial bone involvement.

Eight roentgenograms; 1 photomicrograph.

E. H. PRICE, M.D.
Indiana University

The Skeleton in Paget's Disease. Raphael R. Goldenberg. Bull. Hosp. Joint Dis. **12**: 229–255, October 1951.

The clinical signs and symptoms of Paget's disease show considerable variation, depending upon the extent of pathologic involvement. In advanced cases of polyostotic Paget's disease the deformities of the spine, femora, and tibiae often result in a considerable loss of height. The enlarged head, apparent lengthening of the upper extremities, waddling gait, and bowlegs suggest a simian appearance. The decreased vertical height with the associated increased anteroposterior diameter of the involved vertebral bodies produces kyphosis and scoliosis. Progressive spinal deformity has been known to result in clinical evidence of cord involvement from bone pressure.

Paget observed that the weight-bearing tubular bones become thickened, softened, and deformed. The tibia bows anteriorly, the femur anteriorly and laterally. One of the striking roentgenographic features of the leg in advanced cases of Paget's disease is thickening and bending of the tibia, while the fibula usually remains straight and radiographically normal. Despite the progressive deformity, the bones usually remain strong enough for weight bearing, even in advanced stages of the disease.

Involvement of the neck of the femur produces a coxa vara deformity resulting in a waddling gait. Deformities in the vertebral column with the associated changes in the thorax may cause respiratory embarrassment.

The gross pathological changes consist of osteoporosis circumscripta in the skull in the early stages. In advanced cases the spine and pelvis become extensively involved, with changes in the size and shape of the vertebrae. In the long bones the disease generally begins at one end and spreads, by an advancing wedge of osteoporosis followed by a process of osteosclerosis. As the wedge progresses along the cortex, new bone forms on the periosteal side and is rapidly transformed into Paget bone. The bones of the hands and feet are only rarely involved; the clavicle frequently.

Histologically it is seen that the regular lamellar haversian arrangement is replaced by a mosaic of bone segments fitted in along the cement lines. Encroaching resorption leaves so-called resorption lines as new bone lamellae are apposed, creating the mosaic pattern. Healing is associated with an attempt to reconstruct a more compact bone; the architecture becomes less chaotic and the cement lines become thinner and more regular.

Pathologic fractures of the involved bones are not uncommon and may be the earliest sign of the disease. As to associated sarcoma, the author quotes Jaffe as suggesting that the tremendous proliferative capacity of the tissue involved in polyostotic Paget's disease may be the basic stimulus to tumor formation.

In the differential diagnosis, skeletal metastases from prostatic carcinoma, generalized osteitis fibrosa cystica, and osteomyelitis must be considered.

To date there is no known cure for Paget's disease. The treatment is merely symptomatic.

Ten roentgenograms, eleven photographs and photomicrographs.

THOMAS F. ULRICH, M.D.
The Henry Ford Hospital

The Skull in Paget's Disease. Raphael R. Goldenberg. J. Bone & Joint Surg. **33-A**: 911–922, October 1951.

The enlarged, bossed cranium, originally described by Paget as characteristic of osteitis deformans, and manifest roentgenographically by bony thickening and a cotton-wool appearance, are features now regarded as representing an advanced stage of the disease. So-called osteoporosis circumscripta, which Sosman (Radiology **9**: 396, 1927) regarded as an "absorptive or destructive phase with the productive phase held in abeyance," was definitely established by Erdheim as representing an early stage in the evolution of Paget's disease in the calvarium.

Osteoporosis circumscripta is not as rare as the reported cases would indicate, though its true incidence has never been established. Grossly the porotic area shows a deep red-violet color, caused by increased vascularity of the diploë as it appears between thinned cranial tables. The vessels are increased in size and number, but there is no increase in the thickness of the skull. Local resorption of bone associated with the increased vascularity accounts for the roentgenographic picture.

X-ray examination of autopsy specimens shows the earliest gross lesion as a small rarefied area at the terminal portion of a cranial vascular channel. Confluence of several such areas produces a larger area of rarefaction. The rate of expansion varies, as pointed out by Kasabach and Gutman (Am. J. Roentgenol. **37**: 577, 1937. Abst. in Radiology **30**: 265, 1938). The cranial osteoporosis may be associated with typical Paget's lesions elsewhere in the skeleton or it may precede by as much as eight years the involvement of other bones. The frontal area is the most common site.

As the area of osteoporosis becomes productive, it loses its vascularity. Patchy foci of abnormal sclerosis coalesce to produce the familiar cotton-wool appearance. Although the outer table and the diploë are primarily

involved radiographically, the inner table is not spared. Pathologically the entire calvarium shows involvement.

Osteoporosis circumscripta ordinarily causes no symptoms, nor does it alter the blood phosphatase values. The increase in the latter is the result of new bone formation and is found in the advanced disease. Common findings with polyostotic Paget's disease are weight loss, bone pain, headache, and a waddling gait. Deafness due to eighth nerve impingment is a frequent complication. Mental disturbances have been recorded.

Osteogenic sarcoma developing in a person over fifty-years old may represent a complication of unrecognized Paget's disease. An accurate estimate of the frequency of sarcomatous degeneration is not easily obtained because only cases with advanced skeletal disease are usually reported. The author reviewed 211 reported cases of Paget's disease, of which 5.2 per cent showed sarcomatous change.

Six roentgenograms; three photographs.

D. D. ROSENFELD, M.D.
Fontana, Calif.

Unilateral Proptosis Due to Fibrous Dysplasia of Bone. Report of Two Cases. Robert B. King and George J. Hayes. Arch. Ophth. **46:** 553-559, November 1951.

Two cases of long-standing unilateral proptosis due to monostotic fibrous dysplasia of bone, limited to discrete lesions of the supraorbital plate, are reported. In one case the lesion demonstrated roentgenologically was thought to resemble most nearly a dermoid, although the possibility of its being fibrous dysplasia or an eosinophilic granuloma was also recognized. In the second case the correct diagnosis was made on the basis of the initial x-ray examination.

In neither of these cases were there areas of pigmented skin or abnormal distribution of hair. Skeletal surveys showed no other lesions of bone. The calcium and phosphorus levels of the blood were within normal limits. The possibility of additional bony lesions developing in the future cannot be denied, but no evidence of the polyostotic form of this process could be found during the patients' hospitalization. The surgical approach to each lesion was directed toward total excision of the involved bone. While this appeared to have been achieved, more time will have to elapse before final evaluation in respect to recurrence is warranted.

A third case is briefly mentioned in an appended note.

One roentgenogram; 5 photographs, 1 photomicrograph.

Osteopetrosis. Case Report, Autopsy Findings, and Pathological Interpretation: Failure of Treatment with Vitamin A. Jonathan Cohen. J. Bone & Joint Surg. **33-A:** 923-938, October 1951.

A case of osteopetrosis is reported in a girl who was observed from the age of one year until her death at the age of thirty-two months. When first seen she showed optic atrophy, hearing impairment, and nasal obstruction. Her neuromuscular and mental development were markedly retarded. X-ray examination showed a diffuse increased density involving the entire skeleton. Marrow cavities of long bones were obliterated. The metaphyses showed club-like enlargement and transverse and longitudinal bands. The course of the illness was characterized by a progressive anemia and recurrent infection. Massive doses of Vitamin A were ineffective.

A comprehensive autopsy study was made and the author makes the following observations: (1) The basic abnormality of osteopetrosis is in the bone. It is a failure of normal resorption of the primary spongiosa so that the excess bone, calcified cartilaginous matrix, and osteoid form a dense, hard, homogeneous white mass which obliterates the marrow cavity. This enlarged "chondro-osseous complex" accounts for the opacity seen by x-ray and the widening at the metaphyses of long bones. On gross inspection of a long bone these masses extend from the epiphyseal cartilage to the diaphysis and are conical in shape, with the apices fitting into the hollow ends of the diaphysis. (2) The retarded resorption of the calcified matrix and spongiosa affects all bones, membranous and cartilaginous. The development at the epiphysis proceeds in a normal manner, and the elements of growth at the epiphyseal line are all present, although growth is retarded. The excess osteoid tissue in the "chondro-osseous complex," even though the cartilage and bone matrix are well calcified, can be correlated with a lowered serum calcium. A disturbance in calcium linkage can therefore be postulated. (3) The transverse and longitudinal metaphyseal bands represent fracture lines. Fracture repair is undisturbed. The presence of these lines indicates an increased bone fragility. (4) Replacement of the marrow cavity by the unresorbed "chondro-osseous complex" accounts for the hematological deficiencies. These are the main source of disability, although their severity is not proportional to the severity of marrow replacement. Other factors such as infection and diet probably play a role.

The basis for using vitamin A was the observation in animals that high doses of this vitamin were associated with an increase in remodeling of bone. The reason for its failure in the present case is not explained.

Fourteen illustrations including one roentgenogram; 2 charts.

D. D. ROSENFELD, M.D.
Fontana, Calif.

Therapeutic Acceleration of Bone Age in Osteogenesis Imperfecta. A Case Report. Peter B. Wright, Sangwill L. Gernstetter, and Robert B. Greenblatt. J. Bone & Joint Surg. **33-A:** 939-946, October 1951.

The basic defect in osteogenesis imperfecta is in the osteoblasts, which function poorly and are few in number. The bones become porotic; trabeculae are widely separated; the cortices of the long bones become thin; fractures are common, especially in the lower limbs; epiphyseal growth is normal; if stunting occurs it is the result of the fracture deformities. Callus forms readily and is often more abundant than normal. Short metacarpals, particularly a short fourth metacarpal, may be present. Associated blue sclerae are an interesting feature.

The case reported here is that of a Negro female who sustained seven fractures by the time she was six years old. All were in the lower extremities and five were subperiosteal. At the age of four years and nine months, following her fourth fracture, she received hormonal therapy for ten months, consisting of 0.1 mg. of stilbestrol daily and 10 mg. of methyl testosterone on alternate days. This caused an advancement of carpal bone age by at least five years, and an accelerated development of secondary sex characteristics. After cessation

of therapy, the secondary sex characteristics regressed but the bone age in the wrist and hand was unchanged. Since the epiphyses were not prematurely closed, the authors presume that the skeletal age will be arrested until the chronological age approaches it. No fractures were sustained during hormonal therapy, but it is admitted that this may have been coincidental.

So far as the authors were able to determine, "this is the only clinical case with no endocrine dysfunction in which bone age has been markedly accelerated by sex-hormone therapy."

Eleven illustrations, including 7 roentgenograms; 2 tables.

D. D. ROSENFELD, M.D
Fontana, Calif

Atypical Forms of Bone Sarcoma. Bradley L. Coley. Bull. Hosp. Joint Dis. **12**: 148–173, October 1951.

The author presents case reports of 8 atypical bone sarcomas, each having a long duration and symptoms of mild degree. The roentgenographic appearance of these atypical sarcomas may be very difficult to interpret and may be considered much more indicative of a benign than of a malignant process. Treatment is usually based on the assumption that the lesion is benign, and consequently incomplete removal is the rule and recurrences are common. Periods of three to five or more years may elapse, at the end of which, with disease still present, some more radical procedure is finally carried out, with death subsequently occurring from metastasis. The pathologic findings and microscopic picture may be misleading in the earlier stages but ultimately a histologic diagnosis of sarcoma is made.

There are several lessons to be learned from a study of such atypical cases:

1. These lesions should be treated as though they were locally malignant, being excised widely.
2. Suspicion should be aroused by recurrence of a bone tumor which has been diagnosed as benign.
3. For biopsy study, bone lesions should be removed *in toto* whenever this is practical.
4. Postoperative irradiation is contraindicated. The tumors are not radiosensitive. Doses sufficient to have any growth-restraining effect whatever would make it hazardous to attempt future local surgery.
5. When complete and wide local extirpation are not feasible, amputation is necessary to prevent metastases if they have not already occurred.

Twenty roentgenograms; 2 photographs.

THOMAS F. ULRICH, M.D.
The Henry Ford Hospital

Cortical Defect Due to Periosteal Desmoids. Paul Kimmelstiel and Ira Rapp. Bull. Hosp. Joint Dis. **12**: 286–297, October 1951.

The authors present what they believe to be the first description of cortical erosion of long bones apparently resulting from desmoid-like lesions of the periosteum. They present 4 cases.

The presenting symptoms and signs are not distinctive. The roentgen findings are those of subperiosteal cortical erosion, demarcated from adjacent bone by a thin zone of hyperostosis. The cavitation does not have a bony roof. From a roentgenologic point of view the differential diagnosis includes non-osteogenic fibroma, xanthoma, osteoid osteoma, subperiosteal giant-cell tumor, and monostotic fibrous dysplasia.

Histologic study of the lesion identifies its primary origin from the periosteum. The cortical defect begins at the very surface of the bone and the connective tissue filling the shallow cavity is in direct continuity with overlying periosteum. The presence of osteoclasts at the ragged floor of the erosion indicates progressive resorption of the deeper cortical layers.

The fibrous tissue filling the defect is conspicuous by the absence of most of the attributes which characterize the intra-osseous "fibrous lesions." It fails to show multinucleated giant cells except for those actively engaged in resorption of underlying bone; it lacks whorl formation, xanthoma cells, or stromal elements resembling those described in giant-cell tumors or non-osteogenic fibromas. The cellular matrix is essentially the same as that of the periosteum and does not originate from, or simulate, bone marrow elements. It is composed of spindle-shaped cells which are prone to deposit much hyaline and which have a tendency to form fibrillary cartilage and dense collagenous bundles resembling tendinous tissue.

No definite concept of the pathogenesis of this condition has been formulated by the authors. They feel, however, that the lesion is benign. They are doubtful as to whether it should be classified as true tumor formation or as non-tumorous connective-tissue hyperplasia of unknown etiology. They feel that the term "desmoid" is appropriate, since it does not imply a commitment to a given concept of pathogenesis and since it takes a position between true tumor and reactive fibrosis but at the same time indicates distinctiveness of the lesion.

Three roentgenograms; 7 photomicrographs.

THOMAS F. ULRICH, M.D.
The Henry Ford Hospital

Evaluation of Healed Colles' Fractures. John J. Gartland, Jr., and Charles W. Werley. J. Bone & Joint Surg. **33-A**: 895–907, October 1951.

Using a point system for evaluation, the authors found that the functional end-result was unsatisfactory in almost one-third of their 60 cases of healed Colles' fracture. Although the type of fracture incurred accounts partly for this, insufficient reduction and inadequate mobilization are other responsible factors. Fractures were treated in the usual manner, using closed reduction.

For the purposes of the study a series of five roentgenograms was made of both the injured and normal wrist, in the following positions: (1) anteroposterior, (2) lateral, (3) oblique, (4) with the hand in complete radial deviation, and (5) with the hand in complete ulnar deviation. These roentgenograms together with the pre-reduction, post-reduction, and follow-up films furnished a complete roentgenographic coverage of all phases of the fracture.

A high percentage of unsatisfactory results was found in the fractures showing comminution, with fracture lines extending into the radial articular surface. Four components of the fracture were separately analyzed before and after reduction, and one year afterward or later: (1) dorsal tilt, (2) radial deviation, (3) radial shortening, and (4) integrity of the distal radioulnar joint. A residual dorsal tilt had a more direct influence on an unfavorable end-result than the other components. The sequence of films showed that the original reduction in all cases was inadequate for all components. For example, before reduction, the dorsal radial

angle showed backward tilting, −15 to −20 degrees. After reduction the same angle measured +4 to +6 degrees. By the time the follow-up roentgenogram was obtained (one year or later) this reduction was lost and the angle measured 0 to −5 degrees. Reduction of the radial deviation and radial shortening, and correction of a disrupted radioulnar joint followed a similar pattern. In many cases the reduction was lost during immobilization in the cast. Sixty per cent of the cases when re-examined eighteen months after the injury showed a fracture healed in a position typical of a fresh, unreduced Colles' fracture. The cases with the most complete reductions were among those showing excellent end-results.

In spite of incomplete reduction and inadequate mobilization, it was found that, in general, considerable bony deformity must be present before any motions of the wrist are compromised. Residual dorsal tilt did not appreciably affect dorsiflexion in these cases, but did have a decreasing effect on palmar flexion. Lateral motions at the wrist were not appreciably affected by residual radial tilt or by radial shortening, unless these were extreme.

Nineteen roentgenograms; 1 drawing; 8 tables.

D. D. ROSENFELD, M.D.
Fontana, Calif.

Epiphyseal Injuries in Breech Delivery. Bernard H. Shulman and Charles B. Terhune. Pediatrics **8**: 693–700, November 1951.

During the course of a breech extraction or breech presentation with version and extraction, the extremities of the infant are sometimes injured. Trauma and separation of an epiphysis, with or without apparent dislocation, may occur. When the upper or lower femoral epiphysis is involved, the sequence of events is characteristic. There is usually no hint of injury until the second day of life, when the infant assumes the "frog" position, with the affected extremity held flexed at the knee and hip and externally rotated. The soft tissue over the involved area is full, tense, and often reddened. There are marked tenderness and pain on passive motion. The patient is extremely irritable and may have a low-grade fever. A similar picture prevails when the injury involves an upper extremity.

The underlying lesion is a periosteal elevation, starting at the epiphyseal line and extending as far as the opposite end of the involved bone. The resultant hemorrhage lifts the periosteum and ultimately this subperiosteal extravasation results in the clinical picture described above. By the fifth day, callus replaces the hemorrhage and roentgen examination reveals the calcium-containing healing process, often appearing as an ossifying periostotic sleeve. By this time the symptoms diminish and there is beginning painless motion of the affected extremity. Serial films show gradual complete resorption of the callus, which may take as long as six months.

In general, no specific treatment is necessary unless there is apparent displacement of the epiphysis. When displacement is marked, orthopedic care is necessary. Replacement of the dislocated epiphysis should be attempted and appropriate immobilization of the extremity should be maintained until adequate healing has taken place.

Four cases of epiphyseal birth injury are reported. Three of the mothers were primiparous.

Eleven roentgenograms.

Epiphyseal Chondroblastoma of Bone. José Valls, Carlos E. Ottolenghi, and Fritz Schajowicz. J. Bone & Joint Surg. **33-A**: 997–1009, October 1951.

The authors review the evolution of opinion concerning the classification of epiphyseal chondroblastoma. On the basis of their 8 cases they feel that the basic tumor cell is not the chondroblast, as held by Jaffe and Lichtenstein (Am. J. Path. **18**: 969, 1942) but a reticulohistiocytic cell with a tendency to differentiate into chondroblasts and then into cartilage. Silver-stained sections show reticulin fibers surrounding the basic cells. Other microscopic features were giant cells, cartilage, and foci of extracellular calcification.

The 8 patients ranged in age from thirteen to eighteen years. The tumors showed the following anatomic distribution: 2 in the distal femoral epiphysis; 2 in the proximal humeral epiphysis; 2 in the femoral head; 1 in the proximal epiphysis of the tibia; 1 in the talus. Not all cases were confined to the epiphysis. Aside from the lesion occurring in the talus, 1 case showed the tumor entirely on the metaphyseal side of the humeral head and in another case the tumor began in the femoral head but invaded both the metaphysis and the joint.

The characteristic roentgen finding was a round or oval area of destruction in the cancellous bone, with an ill-defined, hazy border and no cortical expansion. Several of the roentgenograms reproduced show disruption of the adjacent cortex.

The course of these cases indicates that the lesion is benign. Malignant varieties, however, have been reported. Histologically and clinically these may be difficult to differentiate from the benign form. Conservative therapy proved adequate in the 7 cases in the present series which received treatment. The authors seem to prefer curettement when feasible. They used roentgen therapy alone in 2 cases, 1 in which surgery was contraindicated because of a wound infection, and 1 in which surgery was impractical because of extensive involvement of the femoral head and of the acetabulum. Irradiation details are not included.

Follow-up ranged from two to twelve years. Five of the patients were well five years or more following treatment.

Thirty-nine excellent illustrations, including 21 roentgenograms and 14 photomicrographs.

D. D. ROSENFELD, M.D.
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Chondrodystrophia Calcificans Congenita (Dysplasia Epiphysialis Punctata). Walter G. J. Putschar. Bull. Hosp. Joint Dis. **12**: 514–527, October 1951.

Only 35 cases of chondrodystrophia calcificans congenita have been reported in the literature. The lesion is present at birth, consisting of multiple small calcified foci in the epiphyseal and other cartilaginous portions of the skeleton, which are readily demonstrable roentgenographically. The permanent and visceral cartilages are usually unaffected. In time the calcified foci become smaller and fewer and tend to disappear. The condition should not be confused with "stippled epiphyses" due to multiple ossification centers.

The disease is twice as frequent in females as in males. There is usually no hereditary or familial tendency, although cases have been reported in siblings.

Normal blood calcium, phosphorus, and alkaline phosphatase have been found in those cases in which biochemical studies were made.

Dwarfism with unilateral and symmetrical shortening of the long bones is common. The diaphysis may be flared and plump, the epiphysis enlarged. Often the cranium appears large and the bridge of the nose depressed, as in achondroplasia. Contractures are not uncommon; dislocation of the hip, foot deformities, kyphosis, and scoliosis may be present. In some cases unusual hardness or denseness of the bones has been noted. Associated extraskeletal anomalies are occasional cataracts and scaling skin lesions.

An autopsied case is described and 8 cases from the literature in which anatomical studies were done are presented in abstract. A full bibliography is appended.

One roentgenogram; 6 photomicrographs.

THOMAS F. ULRICH, M.D.
The Henry Ford Hospital

Cutaneo-Osteovesical Fistula. Report of a Case Following Fracture of the Pelvis, Rupture of the Bladder, and Hip Fusion. J. J. Kaufman. J. Bone & Joint Surg. **33-A:** 1017–1020, October 1951.

A case is reported of cutaneo-osteovesical fistula developing some two and a half years after the patient sustained a pelvic fracture with rupture of the bladder. Roentgenograms following the injection of Diodrast into the cutaneous opening showed the fistulous tract to pass through the head of the femur and fovea centralis, entering the true pelvis along the linea terminalis and penetrating the floor of the bladder. It was not demonstrable by cystography.

The treatment of such fistulae should consist in adequate drainage of abscesses, removal of sequestra, establishment of adequate bladder drainage, and control of infection by chemotherapeutic and antibiotic agents.

Three roentgenograms.

Discussion on Myelography. Hugh Davies, R. G. Reid, G. K. Tutton, et al. Proc. Roy. Soc. Med. **44:** 881–893, October 1951.

Davies, opening this Discussion on myelography, considers particularly the technic of examination. He regards Pantopaque as the medium of choice, since it has the great advantage of causing no detectable reaction in the majority of patients. (Other participants in the Discussion speak of using Myodil as well.) A series of 106 cases is cited in which 6 c.c. of Pantopaque was permitted to remain in the subarachnoid space. Reassessment of 26 cases (after how long a period is not stated) showed fixation of the medium in the basal cisterns with no symptoms or signs attributable to its presence. Unless there is evidence of manometric block, 6 c.c. of material is routinely used. This is injected by the lumbar route. Fluoroscopy with anteroposterior and lateral films of the prone patient on a tilting table is the procedure routinely employed.

Myelography is indicated for (1) localizing a spinal lesion, (2) showing or excluding multiple lesions, and (3) to afford evidence of the extent of the lesion and its relationship to the dura.

Reid, continuing the Discussion, points out that the majority of spinal tumors are benign and do not infiltrate the surrounding bone. Decalcification, followed by erosion and destruction of bone are the findings on routine radiological examination. The pedicles are eroded and an increase in the interpedicular distance may be the first clear evidence of the location of the lesion. Intramedullary tumors, comprising 20 per cent of intraspinal neoplasms, classically produce a fusiform filling defect. Ependymoma arising from the central canal is the commonest lesion and causes bone changes in a high percentage of cases. Other gliomas attain a large size without bone changes. Syringomyelic cavities are the commonest non-gliomatous lesions. Angiomas produce a characteristic pattern of enlarged serpiginous vessels. Swelling of the cord by intramedullary tumors widens the space between the anterior and posterior nerve routes and consequently the root pockets appear larger than normal. Extramedullary tumors obliterate the root pockets.

Extramedullary tumors which are intradural in position constitute about 60 per cent of spinal tumors. They are usually not examined until there is complete block, forming a "crescentic" defect in the contrast medium. Bone destruction is common and more pronounced in neurofibroma than meningioma. The extradural group, comprising the remaining 20 per cent, are frequently detected by their effects on the soft tissues and their erosive action on the bone.

Myelography is seldom used for lumbar disk lesions but is routine for study of the cervical disks.

Tutton's contribution to the Discussion is from the surgeon's point of view. He analyzes 105 consecutive cases of spinal lesions, in 60 per cent of which myelography was done. Of 14 cases in which the myelographic examination was positive for a cervical disk lesion, only 9 showed a convincing lesion on exploration. Cervical disks were found to fall into three groups: (1) anterolateral protrusion causing a "bite" out of the column of medium, (2) a diffuse medial bulge, and (3) an ossified type that may take the form of a median bar or a bony ridge rising from the attachment of the annulus to the backs of the vertebral bodies. The last two groups produce partial block and indentation of the column in the lateral view.

In the presence of a tumor, the value of myelography is primarily to establish its exact location. Twenty-six out of 33 tumors in the series cited produced complete block and therefore localization only was possible. In only 2 cases could it be determined whether the tumor was intra- or extradural. The site of attachment could be lateralized by observation of displacement of the cord. The wider subarachnoid space is on the same side as the tumor.

Brief comments by other workers complete this Discussion.

Nineteen figures, including 10 roentgenograms.

DAVID C. GASTINEAU, M.D.
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Roentgenographic Abnormalities in Disease of Cervical Intervertebral Disks. Report on 23 Patients with Compression of Cervical Root. George Ehni. Texas State J. Med. **47:** 689–694, October 1951.

Degenerative and traumatic disturbances of the cervical intervertebral disks, which are common causes of pain in the neck, shoulder, scapular region, arm, and hand, so frequently show roentgenographic abnormalities that x-ray examination is important in their diagnosis and in separating them from other conditions such as cervical rib, scalenus anticus syndrome, neoplasms of the spinal cord, syringomyelia and neuritis. Disk disturbances include (1) herniation, (2) a dorsal prominence of the disk consisting of a hard osteoarthritic ridge sufficient to compress a nerve root in its foramen, and (3) collapse of a disk to such an extent that the foramen is distorted and the root compressed.

The present report is based on 23 consecutive cases of surgically proved cervical disk disturbances causing compression of the cervical roots. In only 4 of the 23 patients did the cervical spine appear normal on the plain lateral roentgenogram. Of the remaining 19, 17 showed alterations in the cervical curve ranging from mere straightening of a segment of the curve to localized reversal, centering at a single interspace. Seven of the patients had a cervical gibbus and in all but one of these the lesion producing the root pain was found at the site of the cervical curve reversal. Sixteen of the 19 patients with abnormality observed on plain roentgenograms showed osteoarthritic changes at one or more disk spaces, while 13 patients had narrowing of the interspaces. It was noted that changes limited to a single interspace usually, but not invariably, correctly indicated the site of root involvement.

Myelography was performed on 21 of the 23 patients. There are five abnormalities which may be seen in the postero-anterior cervical myelograms of patients with cervical disk herniations. These are (1) exaggeration of the normal radiolucency over a disk, (2) broadening of the root bundle shadow within the sleeve in a lateral compression lesion of the root, (3) medial displacement of the root and its sleeve shadow complex so that all the root complexes on one side do not appear in a straight vertical line, (4) cephalad displacement of a root sleeve shadow on one side or the other, and (5) obliteration of the entire root sleeve shadow with more or less indentation of the oil column.

Sixteen roentgenograms.

LAWRENCE A. PILLA, M.D.
University of Louisville

Derangement of the Intervertebral Disk. Possible Pain Mechanisms. Harry B. Macey. Texas State J. Med. **47**: 695–699, October 1951.

While posterior protrusion of the intervertebral disk is the commonest cause of low back and sciatic pain, other changes, involving derangement of bony anatomic relations in the lumbar spine, may also be of clinical significance. After the second decade of life, the component parts of the intervertebral disks show regression with gradually increasing degenerative changes. In the advanced decades conspicuous fissuring of the annulus fibrosus and fibrous replacement of the nucleus pulposus occur. As a result of degeneration, the equilibrium between the disk and the ligamentous system is destroyed, and this is only incompletely compensated for by arthritic ledges and buttresses.

The result of intervertebral disk changes may be demonstrated roentgenologically in the following conditions: (1) narrowing of the intervertebral disk spaces with associated changes in the posterior articulations, (2) posterior subluxation of the fifth lumbar vertebra, (3) intervertebral herniation, and (4) posterior herniation.

Narrowing of the disk spaces in young persons is usually the result of severe trauma, but changes in the component parts of the disk may not be demonstrable roentgenographically for several years. In later life narrowing may occur with no known history of acute injury, though it is commonly seen in persons who have led a vigorous physical life with repeated trauma to the spine. With narrowing of the disk space there may be sclerosis of the bony surfaces of neighboring vertebral bodies.

If the changed relationship of the facets is sufficient, impingement may occur between the tip of the superior articular facet and the pedicle or transverse process above, or between the tip of the inferior facet and the lamina of the arch below. Bony encroachment and impingement *per se* lead to arthritic changes and pain. Constriction or pressure on nerve roots results in sciatic pain.

Posterior displacement of the fifth lumbar vertebra can result only from disturbances in the normal anatomy of the posterior articulations and the intervertebral disk. Posterior narrowing of the lumbosacral space should arouse suspicion of such a changed relationship.

In acute trauma to a normal spine or acute pain with little or no trauma to an osteoporotic spine, intervertebral herniation of the nucleus pulposus should be considered.

Posterior dislocation of the nucleus pulposus may produce low back pain without sciatic pain by direct irritation of the nerve endings in the posterior longitudinal ligament and annulus fibrosus. Nerve root compression with sciatic pain eventually ensues. For confirmation of posterior protrusion, myelography is usually satisfactory. A defect which appears small on the myelogram, however, may prove on operation to be large, due to narrowing of the dural sac or an unusually wide neural canal.

Eleven roentgenograms; 1 drawing.

THOMAS S. LONG, M.D.
University of Louisville

New Lesions of the Wrist: Necrobiotic Pseudocysts Cysts Resulting from Capsular Herniation, and Chronic Degenerative Arthritis Due to Marginal Laminar Osteochondrosis. Jean-Pierre Bugnion. Acta radiol., Suppl. 90, 1951. (In French)

Careful postmortem roentgen examination of the wrists of 300 subjects disclosed lacunar images in 179 (60 per cent). In 126 cases the lesion was bilateral and in 53 unilateral. Cystic lesions were demonstrated roentgenologically without question in 141 cases (bilateral 67, unilateral 74). The capitate and lunate bones were most frequently involved by the cysts. The left wrist was affected a little more frequently than the right. Neither the sex nor the occupation of the subject seemed to be a factor. The frequency and extent of the lesions increased with age, reaching a maximum between sixty-one and seventy years.

A histologic examination was made of the 18 most radiologically interesting wrists. Three new forms of carpal lesions were demonstrated: (1) cysts which developed as a result of herniation of the synovial membrane into the bone, (2) necrobiotic pseudocysts due to vascular disturbances, and (3) arthritic marginal cysts.

The hernial cysts did not exceed 2 or 3 mm. in diameter and corresponded to the lacunar image observed in young patients. A prerequisite of such cysts was an anatomical predisposition in the form of a "locus minoris resistentiae," the site of the insertion of the ligaments and the penetration of the blood vessels.

The necrobiotic cyst may be large, 8, 10, or more millimeters in diameter. It is found especially in the aged and often coexists with the hernial form. It results from a vascular disturbance, which the author has been able to demonstrate microscopically in several instances.

The marginal cyst is particularly important because of its arthritic manifestations. There are two principal

variations: (1) a cartilaginous lesion secondary to the presence of a cystic formation beneath the articular cartilage, and (2) an elective lesion of the bony frame, which has been called "marginal laminar osteochondrosis." It results from an ischemic disturbance and is generally accompanied by cysts of the other two types.

Six roentgenograms; numerous photomicrographs.

Pneumoarthrograms of the Knee. An Aid in the Localization of Internal Derangement. James K. Stack and Robert C. Lockwood. Arch. Surg. **63**: 486–495, October 1951.

In many cases the symptoms and signs of internal derangement of the knee are minimal, intermittent, and evasive, and the exact clinical diagnosis may be very difficult. Because the knee joint is more or less compartmented, complete exploratory arthrotomy requires multiple incisions and is not a satisfactory solution of the diagnostic dilemma. In many cases pneumoarthrography may be the only means of obtaining objective evidence, and it is therefore of great value in determining specific treatment.

The present report is based on 144 cases of which 107 underwent arthrotomy. The percentage of error in the preoperative diagnosis in this group was 4.7 per cent. The authors describe their technic of pneumoarthrography and present 6 illustrative cases.

Eighteen roentgenograms; 1 photograph.

DONALD F. MAURITSON, M.D.
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A Device for External Fixation for Fractured Femoral Neck. M. A. Zehnder. Schweiz. med. Wchnschr. **81**: 1057–1058, Oct. 27, 1951. (In German)

The author describes an instrument which facilitates the operative procedure of skeletal pinning of the femoral neck. The instrument is made of two so-called transporters perpendicular to each other, upon which angulations can be determined, anchored to a base plate. In principle this device allows the operator to insert a Kirschner wire into the fractured femoral neck without the necessity of an open operation. The steps in the procedure are as follows: (1) with the base device of the instrument placed along the lateral aspect of the thigh just below the level of the greater trochanter, two Kirschner wires are inserted blindly into the femoral shaft at the cranial aspect of the device and another Kirschner wire is inserted at the caudal aspect. This provides a base for insertion of the pins into the femoral neck. (2) The "transporters" are attached to the base and roentgen exposures are made in anteroposterior and axial (lateral) projections. The femoral neck pin is then inserted.

Two roentgenograms; 2 photographs.

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An Anomalous Tarsal Bone. Allan B. Hirschtick. J. Bone & Joint Surg. **33-A**: 907–910, October 1951.

An unusual case of anomalous tarsal bone of the right foot is reported. The bone was demonstrable roentgenographically as a large osseous body on the lateral aspects of the talus and calcaneus, with evidence of pressure defects on both of these bones. At operation the anomalous bone was found to form a shallow articulation with the talus above, curving downward and backward to articulate with the calcaneus below. It measured 21 mm. in length, 12 mm. in width, and 10 mm. in thickness. The designation "os talocalcaneus" is suggested.

Two roentgenograms; 1 drawing; 2 photomicrographs.

Some Observations on the Morphologic Basis for the Roentgenographic Changes in Childhood Leukemia. Richard H. Follis, Jr., and Edwards A. Park. Bull. Hosp. Joint Dis. **12**: 67–73, October 1951.

Leukemia in childhood ordinarily runs a rapid course characterized by fever, progressive anemia, purpura, and enlargement of lymph nodes, liver, and spleen. Pain about the joints or in the bones on pressure may be prominent as well. Roentgenographic examination of the skeleton reveals certain well recognized changes. The most prominent of these are localized and/or generalized rarefactions of medullary or cortical bone. Periosteal layering, particularly in the long bones, may also be found.

Rarefaction: The cause for areas of decreased density is obscure. It is likely, however, that the diffuse rarefaction is associated with the general wasting which is such a prominent part of the disease. In addition, the presence of cells in the marrow spaces must also be a factor for the change. Theoretically the leukemic cells could act (1) by pressure, interfering with nutrition, (2) by chemical action on the bone surfaces, (3) by withdrawal of the circulation from the bone cells through competitive demand on the nutritional supply, or (4) through some kind of action of an unknown nature on the osteoblastic group of cells, stimulating them to destructive activity.

In some of the cases observed by the authors, destruction by the osteoblastic cells appeared to be proceeding vigorously, but in many cases it seemed as if the leukemic infiltrations themselves were destroying the bone, because such cells were in absolute contact with the bone surface which had every appearance of being in the process of destruction, and there seemed to be a total absence of the osteoblastic-osteoclastic group of cells. The areas in which the appearance suggested that the leukemic infiltrations were themselves destroying the bone were where the surface of contact was completely bare of its endosteal covering. This observation makes the authors wonder if the endosteal membrane is not essential to the maintenance of the integrity of the bone surface and whether, when this is broken or disappears, leaving the bone exposed, destruction may not take place from other kinds of cells than the osteoblastic group. Even in the ordinary destruction of bone, in which the osteoblasts and osteoclasts appear to be the destructive agents, the surface areas in which the destruction is taking place always seem to be bare.

Fractures: Fractures are the consequence of the generalized or localized rarefaction. The breaks may be localized or occur across the entire width of the bone. They are found a few millimeters beneath the cartilage and involve bony trabeculae. In this particular they differ from the fracture so characteristic of scurvy, which is composed of fragments of calcified cartilage matrix just at the cartilage-shaft junction.

Periosteal Changes: Roentgenographically, layering of the periosteum is a prominent feature of leukemia and is of great importance from the diagnostic standpoint. When bones exhibiting this change are studied

histologically, the reason is perfectly plain—leukemic infiltration. Lymphoid or myeloid cells are found between the periosteum and cortex. The layering so characteristic in the films results from the formation of new bone beneath the innermost layer of periosteal cells.

Four roentgenograms; 12 photomicrographs.

THOMAS F. ULRICH, M.D.
The Henry Ford Hospital

Sickle Cell Anaemia. Report of a Case with a Note on Therapy. I. J. Grek and Margaret Findlay. South African M. J. **25**: 780–784, Oct. 27, 1951.

Only 3 instances of sicklemia have been recorded in South Africa. This is surprising in view of the high incidence of the sickle-cell trait in negroid peoples elsewhere. The authors present a case of sickle-cell anemia in a 17-year-old girl of Xosa-Liberian parentage. The x-ray findings in this case were similar to those described by Macht and Roman (Radiology **51**: 697, 1948) and Carroll and Evans (Radiology **53**: 834, 1949). In addition, there was a marked narrowing of some of the intervertebral disks, with irregularity and blurring of adjacent vertebral surfaces; this feature does not appear to have been mentioned elsewhere. Periosteal reaction was not present in this case, and the patient at no time had ulcers on the legs. There was no evidence of cardiac abnormality, and the skull was normal roentgenologically.

Early administration of oxygen and nicotinic acid seemed to be of considerable help in the treatment of the crises in this patient.

Four roentgenograms.

Non-Specificity of Synovial Reactions. Mary S. Sherman. Bull. Hosp. Joint Dis. **12**: 110–125, October 1951.

The normal synovial membrane is composed of connective tissue and a surface layer of synovial cells, which apparently produce mucin. There are only two general ways in which the synovia can respond to pathological conditions: by overgrowth and by degeneration. This was noted many years ago by Nichols and Richardson, who introduced the terms proliferative arthritis and degenerative arthritis but at the same time pointed out that these two types of pathologic change did not correspond to any definite and distinct diseases. In spite of this, the term "proliferative arthritis" has through general usage become synonymous with Still's disease, atrophic arthritis, rheumatoid arthritis, etc., and it has been contended that the pathologic changes are specific, constant, and even diagnostic. The term "degenerative arthritis" also passed over into clinical use and soon became, itself, an indiscriminate diagnosis rather than the description of a type of pathologic change.

Cases of various disorders such as osteoid osteoma, chondroblastoma, torn semilunar cartilage, osteochondritis dissecans, and others, are presented to demonstrate that every characteristic feature of the morbid anatomy of rheumatoid arthritis may be demonstrated in joints which are obviously not involved by rheumatoid arthritis.

The author concludes that: (1) observable morphologic changes often do not permit a diagnosis on the basis of etiology even when the clinical picture is clear; (2) there is no justification for assuming that all joint tissues which exhibit similar "non-specific" changes have been affected by the same disease process; (3) there is no histopathologic feature which is pathognomonic of rheumatoid arthritis.

Three roentgenograms; 11 photomicrographs.

THOMAS F. ULRICH, M.D.
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THE GENITOURINARY SYSTEM

Use of the Cystogram and Urethrogram in the Diagnosis and Management of Rupture of the Urethra and Bladder. Jarratt P. Robertson and James W. Headstream. South. M. J. **44**: 895–901, October 1951.

Rupture of the lower urinary tract with extravasation of urine or irrigating fluid is an emergency in which morbidity and mortality are reduced by early diagnosis and treatment. The cystogram and urethrogram are the safest, easiest, and most accurate of diagnostic aids to determine the presence, size, location, and nature of such injuries. Intra- and extraperitoneal extravasation from the bladder can be distinguished. Extravasation from different parts of the urethra can be localized by the fascial spaces in which the contrast medium is seen.

Air cystography is a fairly satisfactory and accurate method, but gas in the lower bowel may cause confusion. Excretory urography is of limited use because frequently patients with this type of injury are in shock and do not excrete the contrast medium sufficiently well or rapidly to outline the bladder.

Retrograde examination with 10 or 20 per cent Skiodan is the best method. A catheter is introduced into the urethra with sterile technic. If obstruction is met before the bladder is entered, gentle injection of the solution can be carried out and a urethrogram can be made. If the catheter passes into the bladder, about 150 c.c. of the solution is injected. The catheter is clamped, and the patient is told to try to void. The location of extravasated fluid can be determined on the roentgenogram. There is no greater danger of infection from this procedure than from other instrumentation done in this condition.

Surgical and supportive therapy in various types of lower urinary tract rupture are discussed, and 12 cases which were treated, with no mortality, are presented.

Six roentgenograms.

MASON WHITMORE, M.D.
Jefferson Medical College

Voiding Cysto-Urethrograms. J. G. Siceluff. J. Urol. **66**: 593–596, October 1951.

The author redescribes his method of obtaining cystourethrograms during the voiding of contrast medium. Films are exposed in right posterior oblique position, with and without the use of a penile clamp, with the right foot elevated 15 inches. Other films are made before and after the bladder is emptied. This method was previously reported by Draper and Siceluff in 1944 (J. Urol. **53**: 539, 1945. Abst. in Radiology **46**: 204, 1946).

The illustrations demonstrate the use of the method in neurogenic bladder, urethral strictures following pelvic fractures and inflammatory changes, and multiple urinary sinuses.

Sixteen roentgenograms.

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Retrocaval Ureter. Report of Two Cases Diagnosed Preoperatively in Childhood. Raymond E. Parks and William E. Chase. Am. J. Dis. Child. **82:** 442–445, October 1951.

Two cases of retrocaval ureter in childhood are reported. In the first case the diagnosis was made by excretory urography, and the abnormality was corrected by surgery. In the second, the diagnosis was suggested by excretory urography and confirmed by retrograde pyelography. After the retrograde studies, an acute suppurative pyelonephritis developed, which required an emergency right nephrectomy. Because of the patient's poor condition, the right ureter was not explored, but the authors believe that the urographic evidence of retrocaval ureter in this case was unquestionable.

Two roentgenograms; 2 drawings.

Retrocaval Ureter. Saul S. Sapsin and Merlin E. Jacobsen. Texas State J. Med. **47:** 716–717, October 1951.

The author reports the preoperative diagnosis of a right-sided retrocaval ureter in a 23-year-old Negro. The retrograde pyelograms showed a moderate hydronephrosis with a sharp deviation of the ureter to the left in the lumbar region. Since no mass could be demonstrated on perirenal air insufflation, the diagnosis of retrocaval ureter was made.

At operation the ureter was found to pass posterior to the vena cava and in its proximal third to wind around the vena cava, becoming anterior to it and entering the bladder.

One roentgenogram.

LAWRENCE A. DAVIS, M.D.
University of Louisville

Female Urinary Incontinence. Thomas L. Ball and Lynn L. Fulkerson. Urol. & Cutan. Rev. **55:** 591–594, October 1951.

Failure of an operation to cure urinary stress incontinence is discouraging to both patient and surgeon. Unfortunately the incidence of failures is distressingly high. Yet, it is only in recent years that the position of the bladder neck and its physiology have been studied by accurate means. The present paper deals primarily with the determination of the position of the bladder neck in relation to the symphysis in cases where surgery has failed and in those with a successful outcome.

The position of the bladder and its excursion during straining are the factors upon which the presence or absence and possibly the degree of incontinence depend. A method has been devised to determine the position of the bladder roentgenographically and to demonstrate any deviation from the normal. A modified Foley catheter with sealed tip is inserted into the bladder. The bladder is filled with 5 per cent sodium iodide and the catheter with 30 per cent sodium iodide to afford contrast. The external meatus is marked with a metal marker and an exposure is made in the lateral upright position with a metal centimeter ruler between the legs. A second exposure is made while the patient strains down as if to initiate micturition.

Various measurements are then made from the films and compared with average normals. The measurements include lines joining the general slope of the symphysis and the external meatus and the bladder neck. The distance of the bladder neck in front or in back of the lateral bore of the symphysis and the distance below the inferior border of the symphysis are also measured.

A table shows the measurements in postoperative failures and cures. The difference between a competent and an incompetent bladder neck is evidently due to an initial position which is too far forward plus an abnormal excursion. From the position and mobility of the urethra as noted on the roentgenograms the surgeon may plan his operation to correct the abnormal measurements found.

Four roentgenograms are shown. Unfortunately the reproductions are poor and the shadows of the contrast medium in bladder and catheter cannot be identified.

BERTRAM LEVIN, M.D.
Minneapolis, Minn.

THE ADRENALS

Calcification of the Adrenal Gland in Infants and Children. Differential Diagnosis and Report of a Case. Frank J. Rack and Robert M. Eiben. J. Pediat. **39:** 618–622, November 1951.

Calcification of the adrenal gland in infants and children is a rare finding and few cases have been reported in which this condition has been discovered antemortem. Pathologic calcification usually occurs in tissues and cells which are the seat of disease. Foci of dense fibrosis, especially hyalinized, and necrotic masses may become infiltrated. Deposition has also been noted around foreign bodies, dead parasites, in thrombi, and in old hemorrhages. Some degenerative changes in certain tumors are also associated with calcific deposits.

A case is presented of a 22-month-old white girl who had calcification of the right adrenal gland due to an old hemorrhage. The calcification was confined to the right side and was probably secondary to trauma at the age of sixteen months. It was apparent as an area of increased density on a scout film of the abdomen.

One roentgenogram; 1 photomicrograph.

HOWARD L. STEINBACH, M.D.
University of California

THE BLOOD VESSELS

The Radiologic Picture of the Arteria Lusoria (Anomalous Right Subclavian Artery). Guido Lombardi. Radiol. med. (Milan) **37:** 809–816, October 1951. (In Italian)

The author presents a case of anomalous right subclavian artery and discusses the embryology, the anatomy, the clinical symptoms, and the radiological appearance. He states that at autopsy the incidence of a right subclavian artery is 0.4 to 2.0 per cent, while the radiological finding of such an anomaly is rather rare.

The anomalous right subclavian artery usually arises from the distal portion of the aortic arch on the left side of the spine and crosses the midline between the spine and the esophagus. According to Holzapfel, the most common location of this crossing is between C-6 and D-4. The same author states that the anomalous right subclavian artery is found to pass behind the esophagus in 80 per cent of the cases, while in 15 per cent it crosses between the trachea and the esophagus, and in 5 per cent in front of the trachea.

From a clinical standpoint this vascular anomaly is important because it may cause dysphagia and occasionally tachycardia and retrosternal oppression. The anomalous artery may be seen as a long oblique im-

pression upon the barium in the esophagus. This, however, occurs only in those cases in which the artery crosses the midline between the esophagus and the spine; those cases in which the crossing occurs between the esophagus and the trachea or in front of the trachea give no radiological signs.

Five roentgenograms; 5 drawings.

CESARE GIANTURCO, M.D.
Urbana, Ill.

TECHNIC; APPARATUS

Is Our Technical Progress Advantageous to the Patient? Felice Perussia. Radiol. med. (Milan) **37:** 846–849, October 1951. (In Italian)

This delightful article begins with a timely question "When things are simple, why make them complicated?" The author refers in particular to the efforts of some European manufacturer who produced a piece of equipment consisting of a wooden cage, to which a patient could be tied so that his position could be changed at will. The radiologist was compelled to run after the patient along a circular runway.

Professor Perussia asks whether this and many other technics advocated in recent years are really necessary for the diagnosis and truly advantageous to the patient. He also quotes an incident which occurred in his institution when one of his assistants presented to him a number of radiographs and many laminagraphs, purportedly showing a tumor of the nasopharynx. The assistant, however, had failed to look at the nasopharynx with his naked eye and when he did so, no tumor was found.

Dr. Perussia is definitely against complicated technics when simpler ones will make a diagnosis at much less cost and discomfort to the patient, and stresses in his article the necessity of a clinical approach which some radiologists fail to use. CESARE GIANTURCO, M.D.
Urbana, Ill.

Use of Quickly Absorbable Gases in X-Ray Diagnosis. Werner Teschendorf. Acta radiol. **36:** 297–304, October 1951. (In German)

If a pneumothorax or a pneumoperitoneum is to be produced for therapeutic purposes, a gas should be selected which will remain in the cavities for a long time. However, if such procedures are to be carried out solely for diagnostic purposes, a gas should be selected which will be absorbed as quickly as possible after the necessary observations have been made. The author has studied the time of absorption of various gases in the pleura and in the peritoneum of animals and has come to the conclusion that for practical diagnostic purposes the most suitable gases are nitrous oxide, carbon dioxide, and acetylene. The acetylene is inflammable and may produce an explosion, the carbon dioxide may cause some slight irritation. Nitrous oxide, however, does not produce any irritation and seems to be by far the most suitable gas. It is, furthermore, easily available, being used almost daily in any operating room.

For obtaining the proper pressure in injecting the gas, the author uses a system of two large bottles, one of them containing nitrous oxide and the other containing water to which, for antiseptic purposes, some bichloride of mercury has been added. The two bottles are connected with each other by means of a long hose which is attached to an opening in each of the bottles near the bottom. The top of the bottle containing the gas is connected by means of another hose to the needle that is used for the instillation. By elevating the bottle containing the water the pressure can be appropriately regulated. As the water runs into the bottle containing the gas, the gas is gradually forced through the top of the bottle into the needle.

The writer has used this method, particularly for pneumoperitoneum, for over thirty years and has never had any great difficulties. A needle is inserted about two fingers below the umbilicus in the median plane and through this needle two to three pints of nitrous oxide are instilled. The gas is so quickly absorbed that it does not have to be removed from the abdomen, and the patient can go home shortly after the procedure.

By means of pneumoperitoneum, the author has been able to determine the size, shape, and contour of the liver and of the spleen. He has been able to demonstrate tumors of the pancreas and of the adrenals, and has found the method invaluable for the demonstration of intestinal adhesions. Pathological processes within the pleura are similarly demonstrated.

This method is also recommended for pneumoradiography of the kidney beds and the demonstration of tumors of the adrenals. The danger of a gas embolism is markedly reduced because of the easy solubility of the gas within the blood. Further applications are in pneumopyelography and the x-ray study of the urinary bladder. The latter can be visualized either by the gas alone or by a combined method using gas and a radiopaque liquid such as Perabrodil.

In gynecology the author has used nitrous oxide for inflation of the tubes, where, on account of its high solubility, the danger of an embolism has again been greatly reduced. Gas inflation also is of advantage in the x-ray visualization of joints, where the gas can be used either alone or in combination with fluid contrast media.

Nitrous oxide should not be used, however, for myelography or encephalography. In these procedures a fairly large amount of fluid (20 to 30 c.c.) has to be replaced and the rapid absorption of the gas results in a vacuum which may produce a serious disturbance.

One illustration. WM. A. MARSHALL, M.D.
Chicago, Ill.

Intra-Arterial Catheterization of Viscera in Man. Howard R. Bierman, Earl R. Miller, Ralph L. Byron, Jr., Kenneth S. Dod, Keith H. Kelly, and Daniel H. Black. Am. J. Roentgenol. **66:** 555–568, October 1951.

The authors have developed a procedure for intra-arterial catheterization of the viscera in man which has diagnostic and possibly therapeutic implications, since the afferent artery from which a neoplasm obtains its blood supply represents a route of attack upon such a growth. They state that valuable diagnostic information, such as distortions of the vascular pattern by a neoplasm, may be provided by the visualization of the radiopaque substances introduced into the arteries. It is also proposed that by this method various therapeutic agents could be administered in high concentrations directly to the neoplastic lesions.

The investigations were carried out by a team consisting of a surgeon, radiologist, internist, and anesthetist. The technic is described and results of 28 arterial catheterizations performed on 24 patients with metastases from various neoplastic diseases are tabulated. Four serious complications were observed, of

which one was due to a surgical error and one to wound infection.

In this series, the arterial patterns of the liver, spleen, stomach, kidney, and diaphragm were visualized roentgenographically. The celiac axis, hepatic, renal, phrenic, lumbar, superior and inferior mesenteric, and iliac arteries were entered by way of the carotid and brachial arteries. The carotids, subclavian, internal mammary, vertebral, and thyrocervical trunk were catheterized by way of the femoral arteries.

Nineteen roentgenograms; 2 drawings.

W. H. SOMERS, M.D.
Indiana University

Renal Roentgenoscopy and Roentgenography During Surgery. R. J. Prentiss and R. B. Mullenix. J. Urol. **66:** 495–497, October 1951.

The authors have modified the Sutherland kidney clamp by making its blades separable and by providing wide fenestrations in the aluminum kidney-retaining shell. At surgery, the clamp is applied to the kidney and needles are inserted through the fenestrations into the renal parenchyma. Films are then made in two planes, using the kidney clamp to turn the kidney. These become a valuable aid in localizing renal calculi during nephrolithotomy and pyelolithotomy.

Four roentgenograms; 1 photograph.

I. R. BERGER, M.D.
VA Hospital, Chamblee, Ga.

The Quantitative Electrokymograph. Russell H. Morgan and Ralph E. Sturm. Circulation **4:** 604–612, October 1951.

Basic improvements in the design of the electrokymograph are here described in a very technical article. By means of these improvements the authors hope to obtain an instrument which can give accurate measurements of border motion or changes in density rather than the qualitative readings now available. The instrument is also easier to use. [These changes may well result in the electrokymograph becoming a much more important instrument in research and clinical practice. Z. F. E.]

Eleven illustrations. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Stereomicroradiography. Arne Engström. Acta radiol. **36:** 305–310, October 1951.

Historadiography (quantitative microradiography) has proved to be a valuable method of investigation in histo- and cytochemistry. This report describes technics for the determination of thickness of biological samples by microradiography at oblique angles and for stereomicroradiography.

A well developed optical physics discussion is presented to prove the thesis and applicability of stereomicroradiography. Bone samples and cell structure studies are utilized as examples.

Seven microradiograms; 4 graphs and schematic drawings. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

A Systematic Method with New Standards to Determine the Correct Magnitude of Radiographical Exposures. A. Bierman. Acta radiol. **36:** 311–323, October 1951.

To the present the only generally used combination factor in radiograph technic has been one number to denote the milliamperes and the time of exposure in seconds. The author presents a new concept in which he combines the tension (kv.), tube current (ma.), exposure time (sec.), and focus-film distance (meters) into one exposure value. The magnitude of this one exposure factor needed for any particular object to be radiographed is determined by the relative exposure required for a standard object. Two nomograms have been designed to make possible the use of this system without the necessity of employing the original formulae and computation.

Two nomograms; 2 schematic drawings.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Apparatus for Direct Cineroentgenography. Åke S. Gidlund. Acta radiol. **36:** 290–296, October 1951.

A description is given of several types of apparatus for direct cineroentgenography, including one device for obtaining films in two planes and one for obtaining them in a single plane on a continuously moving film strip. All devices are synchronized with the exposure mechanism and are preferably used in conjunction with a special table.

A limited mechanical explanation of the intricate mechanisms is given, with pictures of the many devices labeled for easy identification.

Seven photographs. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Causes of Drying Marks on Radiographs and Their Prevention. Ove Mattsson. Acta radiol. **36:** 273–289, October 1951.

The problem of film drying and the effect upon the final photographic product was investigated by following the changes produced by water droplets. An excellent discussion of emulsion chemistry and physical chemistry is utilized to arrive at the reasons for the changes produced.

Drying is best performed without special heating, at room temperature and with ample circulation of relatively dry air. Artificial or climatic changes of these basic requirements have effects of varying degrees upon emulsion softness, retention of moisture by the gelatin, and upon the production of artefacts due to water droplets.

Accessory agents within the darkroom to combat gelatinous changes and also a so-called "wetting agent" are used to change surface tension and prevent changes in silver deposition by water droplets. The use of this latter material can reduce drying time by 20 per cent and also reduces the incidence of water marks.

Eighteen illustrations, including 14 roentgenograms.

JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

RADIOTHERAPY

Treatment of Oral Cancer by a Combination of Radiotherapy and Surgery. Harold Wookey, Clifford Ash, W. Keith Welsh, and R. A. Mustard. Ann. Surg. **134:** 529–538, October 1951.

The term "oral" cancer is used to include malignant lesions of the lip and oral cavity, back to and including the anterior pillars of the tonsils and the base of the tongue. The material presented in this paper includes 1,128 lesions of the lip, 342 of the tongue, and 497 elsewhere in the oral cavity.

The average age of the patients was sixty-three years, and males predominated, accounting for 98 per cent of the lip cancers and 80 per cent of the other intra-oral lesions. Remote metastases were exceptional.

The response of the primary lesion to radiation was found to depend not so much on the histologic type of cancer as on the position in which the lesion occurred and its accessibility to radiotherapeutic measures.

About 3 per cent of the patients were suffering from syphilis, and in these the cancer was more resistant to treatment and prognosis was relatively poor. Of the tongue lesions, 8 per cent were associated with syphilis. The authors regard leukoplakia as unquestionably precancerous. Malignant change in leukoplakia is suggested by ulceration, bleeding, or irregularity of the surface.

Treatment of the primary lesion is considered to be a radiologic problem, with the following exceptions: (1) Where a lesion occurs on the dental ridge of the mandible and is shown by x-ray to involve the bone, the surgical removal of part of the jaw, together with the primary lesion, is indicated. (2) A lesion which has failed to respond completely to irradiation, leaving residual carcinoma, or one that has resulted in a chronic ulcer, must be dealt with by excision and occasionally by plastic repair.

Invasion of lymph nodes necessitates a neck dissection. In only 13 per cent of the cancers of the lip in this series were nodes involved at any time, whereas in cancer of the tongue and other intra-oral structures the incidence of lymph node involvement was 60 per cent. This high incidence of lymphatic spread of tongue and intra-oral lesions justifies prophylactic dissection, particularly in the younger age group.

Details as to the treatment of the series reviewed are not given but some general principles are laid down. For radiation therapy careful planning is necessary to obtain a dose which will be lethal to the tumor and cause the least possible damage to the surrounding tissues. To achieve this, a combination of roentgen irradiation and some form of radium therapy is often required. Failure may result from over-treatment as well as from under-treatment.

A neck dissection, when undertaken, should be complete, a block dissection of the affected side being done, with removal of the submaxillary salivary gland, sternomastoid muscle, and jugular vein. Removal of these structures produces little if any disability. The external carotid and its branches may be sacrificed, but removal of the internal or common carotid may cause serious cerebral complications or death. Dissection of nodes of both sides may be carried out, but at different times. Removal of the second jugular vein should be avoided if possible. Where a small section of the jaw has been removed, a bone graft is possible.

Palliative irradiation and various measures for relief of pain are briefly discussed. The results of treatment are presented in a series of tables. The five-year survival rates (gross) were as follows: for the 1,128 cancers of the lip, 58.4 per cent; for the 342 cancers of the tongue, 33.6 per cent; for the 497 other oral cancers, 31.8 per cent.

Twenty-three illustrations.

I. EARL HOLMES, M.D.
University of Louisville

Treatment of Metastatic Breast Cancer in Bone. Merrell A. Sisson and L. H. Garland. California Med. **75:** 265–270, October 1951.

Bone metastasis is a common complication of breast carcinoma, occurring in some 75 per cent of autopsied cases and having been reported in approximately 28 per cent of patients with operable carcinomas subjected to radical mastectomy (Nohrman: Acta radiol., Supp. **77,** 1949. Abst. in Radiology **55:** 929, 1950). Pain is the presenting complaint in 95 per cent of the cases. This symptom may precede radiographic evidence of metastatic disease, since rather extensive medullary involvement may be present before it can be detected radiographically. In the cortex, however, a lesion measuring 5 mm. or more will be demonstrable. The lesions are osteolytic in 75 per cent of the cases, osteoblastic in 10 per cent, and mixed in the remaining 15 per cent.

In patients suspected of metastatic disease in bone, diagnostic procedures should comprise routine x-ray surveys of the skull, chest, spine, and pelvis, and routine laboratory studies, including a blood serum calcium determination. Hypercalcemia has been reported in 14 per cent of this group. It produces gastrointestinal disturbances, mental changes, and renal impairment, which are too often attributed to brain metastases, uremia, or bowel obstruction.

The treatment for metastatic bone disease from the breast is palliative and is delivered in the form of radiation and/or steroid hormone therapy plus general supportive care. External roentgen therapy is considered the procedure of choice. The factors employed in most of the authors' cases are 200 kv., h.v.l. 1.0 mm. Cu, and a focal-skin distance of 50 to 80 cm. The fields are of sufficient size to include the involved areas. The total tumor dose ranges from 500 to 1,000 r delivered in one to two weeks in increments of 100 to 200 r, in air, daily. Satisfactory or complete relief of pain was obtained in 68 per cent of 79 cases previously reported by the authors (J. A. M. A. **144:** 997, 1950. Abst. in Radiology **57:** 620, 1951). Half of these maintained a remission during the remainder of their survival, which averaged twelve months from the onset of bone metastasis. Twenty-six per cent showed a restoration of normal bone architecture in areas of previously demonstrable osteolytic or osteoblastic foci. Another third of the patients demonstrated stability in the metastatic foci, while the final third of the group showed roentgen evidence of progression in spite of the roentgen therapy. At these dose levels, the untoward side reactions are non-existent or negligible, with mild nausea or temporary epilation being the only undesirable features. This course of therapy can be repeated four or five times during the patient's survival if necessary. The authors

have now treated 107 additional patients but results in this group are not analyzed.

Bone metastases in post-menopausal women appear to respond equally well to either androgens or estrogens but androgens are recommended in women of the pre-menopausal age group. Testosterone propionate may be given in doses of 150 mg. weekly for a total of twelve weeks. This constitutes a full course. The minimal effective dose of diethystilbestrol, Premarin, Dienesterol, and DMS is about 4 gm. in a minimal period of six months; for Ethinylestradiol and estradiol dipropionate, the minimal dose recommended is 200–250 mg., also in a minimal period of six months. Forty per cent of the patients treated with androgens and 33 per cent of those treated with estrogens obtained pain relief, and the average survival in this group was 8.8 months. No bone regeneration was observed in those treated with androgens, while with estrogen therapy one out of six showed recalcification in the osteolytic lesions. Side reactions with hormonal therapy include hirsutism, edema, uterine bleeding, nausea, vomiting, hypercalcemia, urinary retention, and occasionally death.

Comparing the results of irradiation and hormone therapy, the authors sum up their experience as follows: "Roentgen therapy for patients with mammary cancer metastatic to bone resulted in subjective improvement in about 70 per cent of cases and in objective improvement in about 26 per cent. With steroid hormone therapy there was subjective improvement in approximately 40 per cent of cases, and objective improvement was negligible... In the irradiated cases, about 35 per cent of patients had no pronounced progression for a period of three to nine months following treatment, while such apparent arrest occurred in only about 15 per cent of hormone-treated patients."

Six tables.

JOHN W. WILSON, M.D.
Indiana University

Corpus Carcinoma. Howard C. Stearns. West. J. Surg. **59**: 504–509, October 1951.

A report is given on 79 cases of carcinoma of the uterine corpus treated from 1940 to 1949. The planned therapy was based upon application of radium to the endometrial cavity and upper cervix followed in four to six weeks by total hysterectomy and bilateral salpingo-oöphorectomy. This treatment plan was begun because prior treatment by surgery alone had yielded only a 48 per cent five-year survival rate.

For various reasons only 58 of the 79 patients could be treated by radium and surgery as planned. The others received varied regimes of irradiation or surgery but their small numbers make statistical analysis insignificant. Most of the patients were post-menopausal. No correlation could be drawn between pathological grading and the results of treatment. In general, delay in treatment and consequent extent of disease were considered to have more bearing on prognosis than other intrinsic factors.

In the 58 cases treated according to plan, radium dosages ranged from 3,600 to 5,000 mg. hours applied in tandem to the uterine cavity and the cervical canal. Surgery followed in one to two months. Although viable cancer is often found in the uterus at the time of surgery, the author believes the improved results attest to the efficacy of the preoperative irradiation. Fifty-four of the 58 patients (93 per cent) were alive and apparently free of cancer at the time of the report. Twenty seven of the entire group were eligible for five-year follow-up; 85.5 per cent of these survived, and there were no deaths due to cancer.

The author concludes that treatment of carcinoma of the corpus by radium and surgery has proved sound in the majority of cases. He plans to continue this plan of attack with the added feature of postoperative irradiation in younger patients, especially when residual cancer is shown to be present at surgery.

D. E. VIVIAN, M.D.
Indiana University

Treatment of Uterine Cancer with Radioactive Cobalt (Co^{60}). Carl-Erik Johanson, Gustaf Östling, and R. V. Gåsström. Acta radiol. **36**: 324–328, October 1951.

The utilization of radioactive cobalt in radiation therapy has several advantages over radium. Its cost is less and it is easy to handle. Before it is subjected to neutron bombardment, it can easily be machined into needles, rods, or other applicators without risk. Also, the beta particles of this isotope have very low energy, and thus elements of low atomic number furnish adequate filtration. The authors use 0.5 mm. of nickel, but aluminum, rubber, and plastics are also suitable.

The only disadvantage of $cobalt^{60}$ is the relatively short half-life of 5.3 years as compared with 1,590 years for radium. The authors believe, however, that this is not a serious drawback. By means of a decay graph drawn up when the isotope is first calibrated, the density of the radiation at any moment can be read.

Some 30 patients have been treated with the isotope at the Women's Clinic in Helsingfors, Finland, without complications. The so-called "packing method," with multiple small foci of radioactive material in the uterine cavity and the cervix, is used. Although it is too early for far-reaching conclusions, it is felt that radioactive cobalt will play an increasingly important part in the treatment of uterine cancer.

One photograph; 1 graph.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Application of Radioactive Colloidal Gold in the Treatment of Pelvic Cancer. Alfred I. Sherman, MacDonald Bonebrake, and Willard M. Allen. Am. J. Roentgenol. **66**: 624–637, October 1951.

The purpose of this paper is to present the findings of a few clinical experiments that were performed in an attempt to improve the present means of delivering safely and selectively higher amounts of radiation to desired volumes of parametrial tissue. Treatment by radioactive gold was given in 10 cases of carcinoma of the cervix, 1 carcinoma of the vulva, and 2 cases of inguinal lymph node metastases.

A 22-gauge spinal needle was inserted through the vaginal fornix into the paracervical tissue and then through the parametrium to the pelvic wall. With the needle in satisfactory position, a syringe containing radioactive gold in pectin solution was attached. As the needle was slowly withdrawn, the gold was injected. Three injection sites were usually selected in each parametrium. The amounts of gold injected were not intended to be cancericidal, but of sufficient volume and strength to be traced and located at surgery, which was to follow.

The report includes a brief description of each case, with the amount of gold injected, its location, and the postoperative findings

The areas where gold was injected showed definite radiation effects. Throughout these tissues large numbers of phagocytic cells in the process of phagocytosing gold particles were found. The lymph nodes contained radioactive gold deposits, and the localized radiation effect on the nodes was apparently proportional, to an extent, to the amount of gold injected. The chief localization of the gold was in the subcapsular region, the hilus of the node, and along the reticulo-endothelial pathways which surround the follicles. Microscopic examination of the parametrium showed the gold particles to be phagocytosed and contained in the lymphatics.

In the 3 cases in which gold was injected in the inguinal areas, it was phagocytosed and carried by the lymphatic channels to the lymph nodes, as was seen in the parametrial injections.

These observations indicate that radioactive colloidal gold may be a useful adjunct to present methods of therapy in carcinoma of the cervix and vulva.

Eight photomicrographs; 1 graph; 1 table.

HAROLD GRIFFITH, M.D.
Indiana University

Gastrointestinal Complications of Irradiation for Carcinoma of Uterine Cervix. Edwin F. Aune and Benjamin V. White. J. A. M. A. **147:** 831–834, Oct. 27, 1951.

Of 670 patients treated for carcinoma of the cervix at the Gynecological Tumor Clinic of the Hartford (Conn.) Hospital from Jan. 1, 1938, to Dec. 31, 1949, and followed for at least six months, 23 had gastrointestinal complications (other than radiation sickness). Six had ileitis and 17 proctosigmoiditis.

Most of the patients with involvement of the rectosigmoid had colitic symptoms—tenesmus and diarrhea—while the sigmoidoscopic examination showed a red, friable, edematous mucosa, later becoming atrophic with telangiectases. An ulcer may develop and perforate, leading to peritonitis. Complications of this type tend to appear within seven months of therapy.

With ileal involvement, the symptoms are predominantly obstructive, and appear from five months to years after irradiation. In some cases the pelvic structures become fixed by scar tissue, in which case differentiation from recurrent carcinoma is difficult.

Three of the authors' 23 patients with intestinal complications died of peritonitis. Two cases are reported here.

One roentgenogram; 2 photographs; 3 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Lymphosarcoma Terminating with Leukaemia. W. R. Gauld. Edinburgh M. J. **58:** 507–513, October 1951.

In 1905, Sternberg presented a group of cases of lymphosarcoma which, although starting locally as an invasive tumor, terminated with a frankly leukemic blood picture. He called this condition leukosarcoma and contended that it was a different disease from both lymphosarcoma and chronic lymphatic leukemia. Few would now agree with Sternberg's contention, and it has been urged that terms such as leukosarcoma be dropped from the literature.

Only 2 examples of leukemia developing in a patient with lymphosarcoma have been encountered within the past fifteen years at the Royal Infirmary, Aberdeen, Scotland, and these are reported here. One patient was a boy of nineteen and the other a girl of fifteen. In both cases histologic examination of lymph nodes showed lymphosarcoma, with no suggestion of lymphatic leukemia. Massive node involvement in the mediastinum, which is rare in leukemia, was present in both patients. In both, deep roentgen therapy brought about a progressive diminution of the nodes, but shortly thereafter signs of leukemia appeared and death ensued within a few months.

Kato and Brunschwig (Arch. Int. Med. **51:** 77, 1933) and others have suggested that the leukemia in such cases is the result of x-ray therapy, and there is some experimental evidence to show that there may be a relationship between irradiation and the appearance of leukemia. Despite this, the author considers irradiation an unlikely cause of the leukemia. At the present time most cases of lymphosarcoma are treated by at least one course of deep x-ray therapy, during which and for some time afterward, serial leukocyte counts are made routinely. If irradiation were the cause of the leukemia this would lead to the early detection and wider recognition of this complication.

Two roentgenograms; 2 tables.

RADIOISOTOPES

Evaluation of Radio-Active Isotopes as an Adjunct to Surgical Diagnosis and Therapy. Murray M. Copeland. J. Bone & Joint Surg. **33-A:** 1021–1030, October 1951.

A review of current studies on radioactive iodine, radioactive phosphorus, radioactive calcium, radioactive strontium, and radioactive gallium, with a good bibliography.

Radioactive Isotopes in Localization of Intracranial Lesions. A Survey of Various Types of Isotopes and "Tagged Compounds" Useful in the Diagnosis and Localization of Intracranial Lesions with Special Reference to the Use of Radioactive Iodine-Tagged Human Serum Albumin. Shelley N. Chou, J. Bradley Aust, William T. Peyton, and George E. Moore. Arch. Surg. **63:** 554–560, October 1951.

Inflammatory and neoplastic processes by disrupting the blood-brain barrier defense mechanism permit entrance of toxic substances into the particular diseased region of the venous system, while the non-involved portions remain protected. This differential uptake is the basis for localization of intracranial lesions by tagged compounds or radioactive isotopes, though other contributing factors, such as change in serum protein, may play a role. A review of the variously used tagged compounds and radioactive isotopes with their advantages and shortcomings is presented.

Radioactive phosphorus (P^{32}) is a beta emitter and its range in brain tissue is approximately 7 mm. Radioactivity from a focus of abnormal tissue can be detected only after a bone flap has been reflected and a Geiger-Müller counter in the form of a brain needle has been inserted in the cerebral tissue areas. This procedure would obviously not be useful preoperatively. Its greatest value is in the more accurate determination of

the gross infiltration of malignant glioma as a guide to the extent of surgical resection.

Radioactive potassium (K^{42}) is a strong beta as well as a gamma emitter and the differential uptake by abnormal brain tissue is high. However, the half-life of 14.2 hours is too short for practical purposes. Because of the rapid decay rate, relatively large amounts of this isotope are necessary to obtain high levels of radioactivity. The gamma emission increases radiation hazards and demands heavier shielding. Also K^{42} is relatively well concentrated in muscle, so that tumors near the base of the skull are difficult to detect.

Diiodofluorescein, a tagged (I^{131}) compound, is secreted rapidly by the liver. Its relative speed of disappearance from the blood stream allows the increased radioactivity retained in the pathological brain tissue to stand out more sharply against the low radioactive content in normal tissue and blood. At this time diiodofluorescein is considered the agent of choice for localizing brain lesions.

Radioactive iodinated human serum albumin (RIHSA) has been found to be selectively concentrated in abnormal tissue in the brain. When given intravenously, it remains in the blood stream a long time; a great part is metabolized by the body, and most of the free iodine is excreted through the urine. Approximately 5 per cent is taken up by the thyroid in twenty-four hours, but this can be reduced by blocking I^{131} uptake with Lugol's solution given twenty-four hours prior to the test. One week is required for complete excretion. The ratio between concentration in tissue and in blood increases on the second and third days after injection. Counts should be obtained daily for two or three days. Disadvantages are the relatively large dose (440 to 500 microcuries) necessary for a satisfactory high counting rate and the increased precautions required in handling the radioactive urine.

Four figures; 1 table. MILTON SEGAL, M.D.
Cleveland City Hospital

Radioiodine (I^{131}) Tracer Studies After Total Thyroidectomy. D. Emerick Szilagyi, Roy .D. McClure, Thomas H. Connell, Jr., John H. L. Watson, and Luther E. Preuss. Ann. Surg. **134**: 546–564, October 1951.

In following the clinical course of 52 cases in which all grossly recognizable portions of the thyroid gland had been removed, it was observed that the degree of depression of thyroid function was significantly less marked than in cases of primary myxedema. In an effort to find the cause of this seemingly paradoxical behavior, 22 of the cases were investigated (one to sixty months postoperatively) for the presence of thyroid tissue in the neck and elsewhere by means of radioiodine (I^{131}) tracer studies.

In 54.5 per cent of the cases studied, active thyroid tissue was found in the thyroid region, and in 4.4 per cent of the cases the remaining thyroid fragments had sufficient function to maintain the patients in an approximately normal euthyroid state. As a group, the cases showed a rough correlation between the cumulative excretion curve and the degree of uptake, but all save one of the excretion curves fell in the definitely hypothyroid state. The latter finding raised the question of whether iodine utilization by the small parenchymatous remnants had characteristics different from those observed in the case of intact glands. Suggestive evidence was found that in cases in which the original lesion was hyperactive there was a greater likelihood of the existence of active thyroid remnants. It was concluded that in any given case it is impossible to predict the degree of radicality of total thyroidectomy; that the differences between the hypo- and athyreosis of the totally thyroidectomized patient and the patient with primary myxedema are quantitative rather than qualitative; and that euthyreosis in a patient after total thyroidectomy is attributable to active thyroid remnants.

The authors state that the practical impossibility of performing a complete thyroidectomy in some cases, and of predicting the radicality of the procedure in any given case without sacrificing the recurrent laryngeal nerve and the parathyroid body poses the question whether the conventional complete lobectomy is a reliable and adequate operation in the treatment of malignant lesions of the thyroid gland. However, the difficulty of making a thyroidectomy truly complete should not discredit the procedure for use in cases where the aim of the surgeon is to prevent or reduce to a minimum the possibility of the recurrence of a nonmalignant lesion.

Ten figures; 7 tables. WILLIAM H. SMITH, M.D.
University of Louisville

Determination of Cardiac Output by a Continuous Recording System Utilizing Iodinated (I^{131}) Human Serum Albumin. I. Animal Studies. William J. MacIntyre, Walter H. Pritchard, Richard W. Eckstein, and Hymer L. Friedell. Circulation **4**: 552–556, October 1951.

Measurement of cardiac output in animals was done by obtaining continuous dilution curves of iodinated serum albumin injected into the jugular vein. The right femoral artery was cannulated into a rubber tube about 3 mm. in diameter and this tubing was fixed over a gamma detector of high sensitivity. The radioactivity of the blood flowing over the detector was then plotted as a function of time. The blood was allowed to pass back into the artery or was collected in a beaker. The mathematical formula for obtaining the cardiac output from the dilution curve is given. The values obtained were checked by measuring the actual flow of blood in the aorta by means of a rotameter (allowance being made for the coronary flow) and were found to agree within 9 per cent.

The authors used I^{131} in the hope of obtaining a method which could be used in man without the need for sampling arterial blood, since I^{131}'s gamma ray can be detected through the skin. Their study will continue.

Six graphs; 2 tables. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Localization of Radioactive *l*-Thyroxine in the Neurohypophysis. J. M. Jensen and D. E. Clark. J. Lab. & Clin. Med. **38**: 663–670, November 1951.

In 1933, Schittenhelm and Eisler (Klin. Wchnschr. **11**: 9, 1932) hypothesized that thyroxine or its metabolic product was selectively concentrated in the midbrain and tuber cinereum. They suggested that a direct connection existed between thyroid gland activity and the iodine content of specific parts of the central nervous system. This hypothesis, and particularly the experiments on which it is based, may be significant. Many steps in the regulation of thyroid function re-

main unsatisfactorily explained. The hormonal mechanism postulated for the pituitary-thyroid axis is incompletely understood. The concept that thyroxine may be selectively localized in the hypothalamus has remained controversial, primarily because of the difficulty in determining the extremely small quantities of iodine involved. The present investigation was undertaken because it seemed likely that radioactive *l*-thyroxine, if selectively localized in any part of the brain, could be identified by counting and radioautographic technics.

Eight adult rabbits were used in the experiment; 5 of these were normal and 3, after being given 12 mc. of radioactive iodine over a six-week period, were hypometabolic. Four rabbits—3 normal and 1 hypometabolic—were given radioactive iodine but no thyroxine. Two normal and 2 hypometabolic animals were given radioactive *l*-thyroxine. All materials were administered intravenously. Two animals in each group were perfused in an attempt to partially fix the brain *in situ* and to wash radioactive material from some of the larger vessels. Blocks of tissue, each about 3 to 4 mm. in thickness, were cut transversely through the brain at arbitrarily chosen levels.

The tissue block counts in the animals receiving radioactive iodine were slightly higher in the 2 animals not perfused. The radioautographs were entirely negative.

The tissue block counts from the animals given radioactive *l*-thyroxine were considerably higher than those from the animals receiving radioiodine alone. The greatest activity was found in the blocks from the region of the tuber cinereum and hypophysis. The radioautographs from the animals receiving radioactive *l*-thyroxine showed a selective localization in the medial eminence of the tuber cinereum, the neural lobe of the pituitary, and the infundibulum. There was no apparent difference in the degree of uptake, under the conditions of the experiment, between the normal and hypometabolic animals. The tissue block counts were higher in the perfused animals. The apparent affinity of the neurohypophysis for *l*-thyroxine would suggest that it is part of the pituitary-thyroid axis.

Experiments are in progress to determine if selective localization occurs in other animals.

Six figures; 2 tables.

Some Autoradiographic Studies of Non-Uniform Distribution of Radioactive Phosphorus in Tissues. L. F. Lamerton and E. B. Harriss. Brit. M. J. **2**: 932–936, Oct. 20, 1951.

Autoradiographic studies were made on rat tissue and also on a human postmortem specimen after injection with active phosphate solution. The autoradiographs of the liver and of other tissues of the reticulo-endothelial system following intravenous injection showed a very "spotty" appearance. After intraperitoneal injection the distribution was found to be reasonably uniform. Autoradiographs of smears of the original solution indicated that particulate material was present which concentrated the activity. This particulate material can arise in the preparation of the active solution but also, it has been shown, by allowing the solution to stand in a syringe, unless special precautions have been taken. The non-uniformity of activity resulting may affect considerably the dosage distribution in the tissue.

Eighteen radioautographs.

Localization of Radioactivity of Colloidal Gold^{198}. A Preliminary Report. Harold F. Berg. Arch. Surg. **63**: 545–553, October 1951.

One of the shortcomings of the therapeutic use of radioisotopes has been failure, except in the case of radioiodine, of specific localization of activity. The author has attempted to localize the radioactivity of colloidal gold by local implantation rather than by specific tissue affinity. Dogs were used for the experiment. Five millicuries of gold was injected by various routes and the dogs were sacrificed after an interval corresponding approximately to one half-life of gold, which is 2.7 days. The concentration in various tissues was measured against a standard radium sample and compared to the concentration in the right kidney, which was considered as unity.

The results after intravenous injection and after injection into the renal and femoral arteries confirmed previous work, showing that the primary localization was in the spleen and liver. However, injection of the renal artery with immediate occlusion of both the vein and artery for one minute showed a concentration in the injected kidney twenty to twenty-five times greater than in the opposite kidney. The splenic artery in the dog supplies the spleen and the distal half of the pancreas. Following splenectomy, injection of the splenic artery with occlusion of the artery and vein showed concentrations of radioactive gold in the pancreas several thousands times those found after intravenous injections. The pleural space was injected in two dogs and also showed a concentration several thousand times above that following intravenous injection. Following intraperitoneal injection, the highest concentration was shown to be in the omentum, with very low uptake in the spleen and liver. In one dog the urinary bladder was filled with 5 mc. of gold for four hours and showed a high specific activity. In one animal found to be pregnant and near term, only infinitesimal activity was present in the fetus.

The results obtained by the author are very interesting and, with longer acting isotopes and more experimental work, suggest many clinical applications.

Ten tables; 1 diagram.

DONALD F. MAURITSON, M.D.
Cleveland City Hospital

Effects of Cortisone and DCA on Radiosodium Transport in Normal and Adrenalectomized Dogs. R. R. Overman, A. K. Davis, and Anne C. Bass, with the technical assistance of Vinton C. Hudson and Elizabeth Ann Stevenson. Am. J. Physiol. **167**: 333–340, November 1951.

Following a thirty-minute blood sampling period after injection of radioactive sodium, the Na^{24} space, erythrocyte Na turnover rates, and relative specific activities of liver, muscle, heart, ileum, lung, skin, spleen, brain, and bone were determined in the following groups of animals (1) normal dogs, (2) normal dogs given 5 mg./kg./day of Cortisone for seven days, (3) normal dogs given 0.5 mg./kg./day of desoxycorticosterone acetate for seven days, (4) adrenalectomized dogs given 5 mg./kg./day of Cortisone for seven days, and (5) adrenalectomized dogs given 0.5 mg./kg./day of desoxycorticosterone acetate for seven days.

At the dosage level employed, both the Cortisone and desoxycorticosterone acetate were found to exert a significant effect on Na turnover dynamics, particularly across capillary membranes. It was likewise apparent

that the direction of the effect of desoxycorticosterone on Na turnover rate is opposite to that produced by Cortisone. The effects of both drugs was more clear-cut in the bilaterally adrenalectomized animals. Specific tissue differences were found which may be partially explained on the basis of differences in tissue vascularization. The data support the hypothesis of antagonisms between the 11-desoxy- and 11–17 oxysteroids as they affect capillary membrane permeability.

Two charts; 3 tables.

Distribution of Radioactivity in Mice Following Administration of 3,4-Benzpyrene-5-C^{14} and 1,2,5,6-Dibenzanthracene-9,10-C^{14}. Charles Heidelberger and S. Marguerite Weiss. Cancer Research **11**: 885–891, November 1951.

It has previously been shown (Cancer **1**: 252, 1948. Abst in Radiology **52**: 776, 1949) that a single dose of the labeled dibenzanthracene-9-10-C^{14} may be quantitatively accounted for by measurements of the distribution and excretion of radioactivity, and considerable information may be obtained as to the chemical nature of the metabolites by systematic chemical fractionations. The investigation is continued with a study of the distribution of radioactivity following intravenous and subcutaneous injection of benzpyrene-5-C^{14} into mice and a comparison of the rates of disappearance of benzpyrene-5-C^{14} and dibenzanthracene-9-10-C^{14} from the site of a single application to the skin. The authors summarize their findings as follows:

"Radioactivity following intravenous injections of benzpyrene-5-C^{14} can be recovered quantitatively. No radioactivity appears in the respiratory CO^2. The compound and its metabolites are rapidly excreted into the bile, gastro-intestinal tract, and feces. There is significant absorption into body fat.

"The half-time of disappearance of radioactivity from benzpyrene-5-C^{14} from the site of subcutaneous injection in tricaprylin [used as a solvent] is 1-3/4 weeks. Excretion takes place through the feces.

"The rate of disappearance of radioactivity from the site of a single application of benzpyrene-5-C^{14} has two phases, the half-times of which are approximately 1-2/3 days and 4-1/3 days."

A fractionation scheme for tissue following injection of labeled carcinogens is presented.

One photograph; 3 charts; 4 tables.

Tracer Studies on the Metabolism of the Gardner Lymphosarcoma. IV. The Conversion of Lactate-2-C^{14} to Alanine, Glutamate, and Aspartate by Tumor and Spleen Cells. Saul Kit and David M. Greenberg. Cancer Research **11**: 791–794, October 1951.

The experiments described here were designed to throw additional light upon the pathways by which lactic acid is metabolized in lymphosarcoma cells and normal mouse spleen cells.

When mouse lymphosarcoma or spleen cells were incubated with lactate-2-C^{14}, significant radioactivity was found in the respiratory CO_2. The only amino acids strongly labeled were alanine, glutamate, and aspartate, though protein was also significantly labeled. Negligible radioactivity was found in the fats. In the spleen cells, the glutamate and aspartate contained almost equal radioactivity, while the alanine was less radioactive. On the other hand, in the lymphosarcoma cells the alanine had twice as much radioactivity and the aspartate one-fifth as much as the glutamate.

RADIATION EFFECTS; PROTECTION

Physiological and Chemical Changes in Radiation Injuries. Frederic T. Jung. Arch. Dermat. & Syph. **64**: 555–561, November 1951.

This paper is a review of the physiological and chemical changes in radiation injuries. The author summarizes the most important points of his discussion as follows: (1) Alpha, beta, and gamma rays, roentgen rays, shorter ultraviolet wave lengths, and neutron beams all act by causing the discharge of free electrons from atoms; this causes chemical changes in water, upsets enzyme systems, depresses functions, and destroys cells. These rays can, therefore, all be referred to as ionizing radiations. (2) They rarely, if ever, stimulate. Their action is primarily depressing and destructive. (3) The wide ranges of radioresistance observed in various test objects under varying conditions may afford clues leading to better control of the biological effects.

Danger of Exposure to X-rays by the "Blind-Nailing" Technique. Charles A. Rowe. J. Bone & Joint Surg. **33-A**: 967, October 1951.

When the surgeon nails hips by "blind technic," he often finds it necessary to hold the lateral cassette during filming. This is a potential hazard, and if a large number of films are thus held, the accepted tolerance dose per day may be exceeded.

The author records an experiment in which dosimeters were placed at various areas of the trunk and hands of one person, during the filming of one case. Five sets of films were required. Two 85-kv., 15-ma. machines were used. The vertical projections did not give detectable exposure. The lateral projections for the five films gave the following doses: belt line, 35 milliroentgens; right side of neck, 28 milliroentgens; left side of chest, 4 milliroentgens; right ring finger, 950 milliroentgens; left ring finger, 125 milliroentgens; left forefinger, 130 milliroentgens.

Mechanical lateral cassette holders are recommended for hip surgery. D. D. ROSENFELD, M.D.
Fontana, Calif.

Radiation Effect on the Unborn Embryo Immediately After Conception. Maxwell Roland and Arthur Weinberg. Am. J. Obst. & Gynec. **62**: 1167–1169, November 1951.

A case in which stimulating doses of x-ray to the ovaries were given in the first two weeks of pregnancy is reported. As roentgen irradiation is used more extensively in sterility cases, the hazards to the progeny of the first or second generation must be considered. A 24-year-old white woman, nulliparous, was seen on June 20, 1949, with a history of infertility. Her menstrual cycles were irregular. Hysterosalpingography demonstrated both tubes to be patent. Endometrial biopsy on the twenty-seventh day revealed a persistent follicular phase. It was determined by basal body charts that the cycles were anovulatory. Hormone therapy established regular cycles but they remained

anovulatory. X-ray stimulation to the pituitary was tried without success.

On Jan. 18, 1950, the patient was given 100 r to the left pelvic region and 100 r anteriorly to the right pelvic region. On Jan. 25, 1950, another 100 r was given posteriorly to the right and to the left pelvic region, both with 200-kv. units and 10 × 12 portals. A third dose was not given because the menstrual period was several days late. The patient proved to be pregnant and was allowed to go to term. Thorough examination of the infant revealed no abnormalities and at six months there were normal growth and development.

JOHN M. KOHL, M.D.
Jefferson Medical College

Further Observations on Inhibition of Lymphoid Tumor Development by Shielding and Partial Body Irradiation of Mice. Henry S. Kaplan and Mary B. Brown. J. Nat. Cancer Inst. **12**: 427–436, October 1951.

The authors have previously reported that mice in which a high incidence of lymphoid tumor is obtained following whole-body radiation do not show this high incidence if the radiation is localized to the mediastinum or the upper or lower half of the body or other small areas (J. Nat. Cancer Inst. **10**: 267, 1949) These results were considered to exclude the hypothesis that such tumors arise solely as a result of a direct effect of x-rays upon a susceptible cell or tissue of origin. Three related experiments are reported that confirm and extend previous evidence that local irradiation is ineffective in the induction of mouse lymphoid tumors and that an indirect systemic mechanism therefore must be implicated.

One group of mice was given four doses of 300 r each at two-week intervals over the upper half of the body only; a second group was given the same dose over the upper half and lower half of the body alternately; a third group received four similarly timed treatments of 150 r each over the whole body; and a fourth group was treated in the same manner except that the mediastinal area was shielded with lead; another group was kept as an unirradiated control. Lymphoid tumor incidence in the five groups, after sixteen months, was 8, 8, 52, 0, and 8 per cent, respectively.

In a second experiment fractionated alternate irradiation of the upper and lower halves of the body at short time intervals yielded a high incidence of lymphoid tumors, almost identical with that of mice receiving equivalent full-body irradiation. However, in mice receiving alternate half-body treatments at a longer time interval, namely four days, the incidence of lymphoma was extremely low.

A third experiment was undertaken to study the effect of preserving ovarian function. The ovaries were transplanted to the muscle of the right hind leg in groups I and II, and left intact in those of group III. During irradiation, mice of group I were unshielded while those of groups II and III had a lead shield placed over the right hind leg. Lymphoma incidence in these groups was 44, 10, and 10 per cent, respectively.

The authors comment that a number of factors, such as genetic constitution, age, endogenous and exogenous endocrine stimulation, dose and technic of administration of the x-rays and shielding have been shown to influence lymphoid tumor induction to an important degree. The available information is consistent with the tentative hypothesis that lymphoid tumor development is dependent upon the attainment of a threshold state in the lymphoid tissues and that this threshold is governed by the physiologic attributes of genetic constitution, by hormonal influences, and perhaps by other factors.

Three tables; 2 figures. D. S. CHILDS, JR., M.D.
Rochester, Minn.

Survival of Adrenalectomized Rats With and Without Replacement Therapy Following X-Irradiation. Abraham Edelmann. Am. J. Physiol. **167**: 345–348, November 1951.

The present investigation was undertaken to obtain quantitative data on the role of the adrenal in the radiation syndrome. In one experiment rats were adrenalectomized and irradiated (650 r of whole-body irradiation, at 160 kv.p., 10 ma., half-value layer 0.2 mm. Cu, 50 r per minute), and the effect of the combined insults was studied relative to either insult alone. In a second experiment adrenalectomized animals were irradiated and treated with either cortical extract or desoxycorticosterone acetate, and the effect on survival of these animals was noted. Treatment of control ani nals was identical with that of exposed animals except that the lead shield of the x-ray apparatus was in place.

The average survival of the adrenalectomized, irradiated rats was 4.1 days compared to 7.8 days for the adrenalectomized controls. An analysis of the variance indicates that this difference is significant. In contrast, 80 per cent of the animals treated with adrenocortical extract and 60 per cent of those treated with desoxycorticosterone acetate were alive twenty days after irradiation. The length of survival of irradiated adrenalectomized rats after discontinuance of the hormone was similar to that of the unirradiated, untreated adrenalectomized rats.

One chart; 1 table.

Acute KCl and Histamine Tolerance and Adrenal Weight in X-Irradiated Mice. Willie W. Smith. Am. J. Physiol. **167**: 321–327, November 1951.

The existence and extent of adrenocortical deficiency and the critical aspects of cortical function in animals subjected to whole-body irradiation are problems of both practical and physiological importance. Adrenalectomy in mice seems to decrease radiation tolerance, and adrenal shielding in rats to afford some protection.

Following adrenalectomy there is an increase in blood and tissue histamine and a decrease in tolerance to injected histamine. The histamine blood level in adrenalectomized animals is lowered and resistance to injected histamine raised by adrenocortical extracts. Potassium concentration in the serum also generally reflects the extent of cortical deficiency, while adrenocortical extract lowers the concentration and to some extent increases tolerance to otherwise fatal amounts of intraperitoneally injected potassium. In the conditions which produce the "alarm reaction," there is a characteristic rise in serum potassium.

Hoping to clarify further the functional aspects of the adrenal cortex in relation to tissue demands in irradiated mice, the author studied potassium and histamine tolerance. The potassium tolerances of irradiated mice and of starving mice were compared, and adrenal weights were determined to see whether or not they would be correlated with the results of the tolerance tests.

Mice subjected to lethal whole-body irradiation of 700 or 800 r showed at one and two days an increased tolerance to intraperitoneally injected potassium chloride, followed by a decreased tolerance. Similar changes in potassium tolerance occurred during the course of starvation. Changes in histamine tolerance after lethal irradiation appeared to be similar to the changes in potassium tolerance. Mice given radiation near the sublethal level (425 r) showed increased tolerance to potassium two and four days after irradiation, with return toward normal on the seventh day.

No correlation between adrenal weight and potassium tolerance was apparent. It does not follow, however, that either measurement is without value in the study of cortical function as related to tissue demand.

Two charts; 4 tables.

Use of X-Ray and Nitrogen Mustard to Determine the Mitotic and Intermitotic Times in Normal and Malignant Rat Tissues. William R. Widner, John B. Storer, and C. C. Lushbaugh. Cancer Research **11**: 877–884, November 1951.

In a previous investigation, x-rays were used to determine the mitotic and intermitotic time of various mouse tissues (Cancer Research **10**: 59, 1950. Abst. in Radiology **55**: 799, 1950). The present study was undertaken (*a*) to extend the data to rat tissues, (*b*) to compare the time components of the mitotic process of neoplastic and normal cells, (*c*) to compare quantitatively the rate of cellular proliferation in various normal and neoplastic tissues, and (*d*) to determine whether or not nitrogen mustard has the same effect as x-rays on mitosis and whether it could be substituted for x-rays in this method of determining mitotic time.

By determining the rate of decline of the mitotic indices of the jejunum, bone marrow, Jensen sarcoma, and Walker rat carcinoma 256 immediately following exposure of rats to x-radiation, it was found possible to determine the length of time spent by the cells in mitosis and the resting stage. Comparison of the results of this experiment with those of others revealed a close agreement between the mitotic times for a wide variety of tissues, derived by several different methods.

From the data obtained, it would appear that the time required for any cell of the rat to produce two daughter cells following breakdown of the nuclear membrane in early prophase is constant and measures approximately 25.4 minutes. It would also appear that the mitotic index of a tissue is dependent upon the length of the interphase or resting stage and that changes in rate of cellular proliferation are the result of changes in the length of the resting stage.

It was not found possible to substitute nitrogen mustard for x-radiation as a means of producing mitotic arrest in this method of determining mitotic time, since nitrogen mustard apparently causes an early premitotic arrest as well as an arrest in early prophase, while also having a colchicine-like effect later in mitosis. These differences in mode of action of nitrogen mustard upon cell division lead to unduly prolonged mitotic times as derived by this method.

Seven charts; 3 tables.

Effect of X-Radiation on the Desoxyribonucleic Acid and on the Size of Grasshopper Embryonic Nuclei. Nyra J. Harrington and Robert W. Koza. Biol. Bull. **101**: 138–150, October 1951.

Cytological and cytochemical studies were made on embryonic nuclei of the grasshopper, *Chortophaga viridifasciata*, after doses of 4,000, 10,000, and 12,500 r. The changes induced were photometrically measured by using (1) the Feulgen reaction to determine relative changes in the desoxyribonucleic acid (DNA) desoxypentose, and (2) methyl green stain to indicate the degree of polymerization of the nucleic acid.

The irradiation produced swelling of the nuclei. When correction was made for this, the Feulgen-stained nuclei showed no significant loss of DNA after irradiation, but the nuclei stained with methyl green disclosed a highly significant loss of stainability. This is interpreted to indicate that x-rays do not destroy the DNA but induce depolymerization of the nucleic acid.

This study indicates that it is not safe to make quantitative estimates of DNA (stained by Feulgen or methyl green) from microscopic observations and photographs. The visually apparent loss of Feulgen-stainability after irradiation is probably not due to a decrease in the DNA desoxypentose but rather to the increased dispersion of the DNA in nuclei that have undergone x-ray-induced enlargement.

Four photomicrographs; 6 tables.

Some Problems of Radiation Protection. The Silvanus Thompson Memorial Lecture. W. V. Mayneord. Brit. J. Radiol. **24**: 525–537, October 1951.

Modern supervoltage machines and isotope workers have complicated the problem of radiation protection. Monitoring of dosages received can be accomplished by some type of portable ionization chamber or by film. Ionization chamber methods have the advantage of high accuracy, but the instruments are mechanically fragile. They are expensive and require considerable skill in handling. Film measurements, though not as accurate, are satisfactory. They have the added advantage of showing something. A worker will be more impressed by a blackened film than by a mere statement of milliroentgens received. Films, however, lose sensitivity at very high and very low voltages. The error in high voltages may be partly compensated for by masking.

Blood counts as a measure of exposure are difficult to interpret and subject to many uncertainties. If they are used, they should be carefully scrutinized for the circumstances under which they are taken. Also, the counts should be done by the same person if they are to be compared.

In a study at the Royal Cancer Hospital, London, nurses caring for patients receiving radium treatment were found to have the largest exposure; next came workers with isotopes. Larger than tolerance doses were found close to a patient with radium in the cervix, which would serve to account for the high exposure of nurses.

Four questions present themselves in connection with protection. How can we teach careful and safe technic? Is a single film an adequate indication of total bodily dose? What is a safe dose? Is a protection service worth while? Mayneord estimates that for 100 people the cost of a protection service will be between $3,000 and $4,000 a year in materials and professional time. He thinks it is worth while. Whether or not a single film is a reasonable indicator of total dose and just what constitutes a safe dose remain to be determined.

Fourteen graphs. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Use of Lead Shot for Protection from Gamma Radiation. A. Nightingale. Brit. J. Radiol. **24**: 568–571, October 1951.

Where lead brick walls have proved impracticable for protection against gamma rays, use has been made of continuous "cavity walls" filled with small lead shot. The author reports a study of the effectiveness of such walls, with the aid of gamma radiographs and with a Geiger-Müller counter. They were found to be a satisfactory means of protection against gamma rays for personnel but not for fixed objects, such as photographic materials. The diameter of the shot should not be greater than the effective source of the radiation and the hollow wall thickness should be at least 1.4 inches.

One gamma radiograph; 2 tables.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Personal Diary of Radiation Dosage. Plea for a Standardized System. M. H. Poppel, J. Sorrentino, and H. G. Jacobson. J. A. M. A. **147**: 630–632, Oct. 13, 1951.

In view of the ever-increasing use of radiation in its various forms, and the trend to reduce the tolerance dose of x-rays, the authors advocate the adoption of a nationally standardized personal radiation-diary system. Each individual would carry such a diary, containing records of all exposures to roentgen radiation—diagnostic (including dental), therapeutic, industrial and occupational—to radium, isotopes, and all other forms of radiation. The record would consist of a series of entries designating the areas exposed, milliamperage, kilovoltage, filtration, distance, dosage rate, and the total dose expressed in roentgens or their equivalent. Such a diary would be of aid to the radiologist about to examine or treat a patient; it would afford better evaluation of previous radiological effects; it would result in better control of fluoroscopy, would serve to increase the use of protective devices and timers, and would have legal value in distinguishing between negligence and necessarily heavy dosage.

Dosages in radiation exposures are discussed, and certain precautions fundamental to radiography and fluoroscopy are outlined, as follows:

All radiographic and fluoroscopic tubes should have a minimum external filtration of 1 mm. Al.

Although the minimum dark-adaptation time for fluoroscopy is fifteen minutes, twenty to thirty minutes is recommended. Failure to observe this precaution results in unsatisfactory fluoroscopic vision, tempting the radiologist to increase the milliamperage or kilovoltage and the fluoroscopic time.

Fluoroscopic exposures should be short and intermittent, and the smallest fluoroscopic field possible should be used.

For abdominal and chest fluoroscopy, the factors should not exceed 3 ma. and 70 kv.; for the extremities, 3 ma. and 60 kv.

No patient should receive more than a total of 100 r in air for any one type of radiographic and/or fluoroscopic examination. Any part of the body receiving 100 r in air should not be re-exposed for three weeks.

A table is included, estimating the total dose in air for exposures of various parts of the body during examination.

FRANK T. MORAN, M.D.
Lancaster, Penna.

Design of Directional Counters for Clinical Use. Brian D. Corbett and A. J. Honour. Nucleonics **9**: 43–53, November 1951.

This paper is mainly concerned with the design of a small directional Geiger-Müller counter for clinical work with I^{131}. Many of the principles involved are applicable also to the case of a scintillation instrument, and mention is made of modifications which would be desirable for directional detection of hard-gamma-ray emitters, such as Na^{24}. The criteria for directional counters are listed as follows: (1) high sensitivity; (2) a polar diagram free of subsidiary lobes; (3) a thick side wall to reduce interference from strong sources on the fringes of the field; (4) a sensitive solid angle constant in size within the field depth; (5) provision for adjusting this solid angle to suit the mean concentration of isotope within the field; (6) small size and weight.

After complicated formulae and graphs (better understood by a physicist than a radiologist) the authors present their "five pounder" design, with graphs showing performance data.

Ten charts; 2 tables. S. F. THOMAS, M.D.
Palo Alto, Calif.

Survey Meters for Water Monitoring. J. B. Hursh, S. Zizzo, and A. H. Dahl. Nucleonics **9**: C-16 to C-20, November 1951.

Because many radiologists are concerned with water monitoring, among their other duties in civilian defense, this article from the Civil Defense section of *Nucleonics* is reviewed for their benefit.

An early evaluation of the degree of contamination in a community's water supply, following an atomic bomb explosion, is essential not only to prevent ingestion of dangerous amounts of fission products but also to avoid the equally serious mistake of denying a stricken community access to drinking water which, in fact, could be used with safety.

The purpose behind this paper is to evaluate the use of conventional monitors in the determination of water contamination. Tests of 6 types of commercially available instruments showed them to be adequate for this purpose.

Details of the procedure with standards and the set-up for this situation are given in detail. The interested radiologist will find the paper well worth perusing.

Two illustrations; 1 table. S. F. THOMAS, M.D.
Palo Alto, Calif.

Decontamination Chart. U. S. Naval Radiological Defense Laboratory, San Francisco, Calif. Nucleonics **9**: C-12 to C-15, November 1951.

Included in a special section of *Nucleonics*, entitled Technical Data for Civil Defense, is an outline of methods of decontamination of paint, asphalt, concrete or brick, tile, wood, and soil, with their advantages and disadvantages. The report is set up in a handy table form, useful for quick reference in any laboratory.

S. F. THOMAS, M.D.
Palo Alto, Calif.

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